



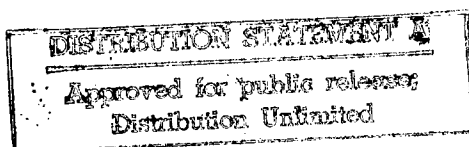
**FOREIGN  
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# ***JPRS Report***

# **Science & Technology**

***Europe***

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# Science & Technology Europe

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## ADVANCED MATERIALS

### Technologies for Space Applications Described

93WS0011A Paris COMPOSITES ET NOUVEAUX MATERIAUX in French 17 Sep 92 pp 3-6

["Materials: Technologies Developed in the Framework of the Space Programs Available at Novespace"]

[Text] Last June the European Space Agency published No. 2 of the TEST catalog. This catalog assembles 56 technologies elaborated in nine European countries within the framework of their participation in the space programs. Our attention was attracted by the group of technologies, arranged according to their characteristics and presenting new materials or innovative technologies involved in the application of such materials. Intended for transfers, all information concerning these technologies can be obtained at Novespace, the technology-transfer company specialized in the space field.

### Filmix, The High-Mechanical-Strength, Pre-Impregnated Thermoplastic Carbon Film

It involves a method for manufacturing pre-impregnated thermoplastic carbon-fiber strands, known under the name of Filmix. This Filmix strand differs from other carbon-fiber strands in that it is impregnated with a thermoplastic material which enables it to be woven and to assume a great variety of shapes. It has a strength greater than that of thermoplastic materials or non-impregnated carbon fibers. In spite of their less expensive fabrication, the usual thermoplastics do not possess the same stiffness as Filmix-based materials which provide a stiffness two times greater than that of aluminum and, hence, a savings in weight. Filmix is assembled by a Foucault-current welding technology and not by means of adhesives or other materials, thereby facilitating the construction of complex structures without loss of strength, material or force in the joints.

The materials formulated on the basis of the Filmix thread will find numerous applications where high strength is sought at the same time as a reduced mass: this is the case of any structure requiring a strong and light material. Today, Filmix is produced in small quantities for structures to be used in space flights. The scope of fabrication of the Filmix strand and the Foucault-current welding technique are both the subject of patents pending in Europe and in the United States (Ref 58).

### High Performance and Precise Tolerance Composite Structures

In order to overcome the difficulty in obtaining a homogeneous composite, a filamentary winding method was developed which permits the fabrication of composite structures in accordance with very precise specifications, provided with predictable and reproducible characteristics. These characteristics remain valid even for big components and for a wide range of composites, including Kevlar.

This technology applies to any composite structure or construction component intended to be used under severe conditions. By reason of excellent manufacturing precision in this process, the safety margins can be calculated to the closest, which permits ponderable savings. At the same time, the best performances obtained with these composites will widen their potential field of application. These high-precision filamentary winding techniques are presently used in shops fabricating satellite structures and space probes. The technology and the know-how are available for non-space applications (Ref 59).

### Ceramic-Fiber Structures for High-Temperature Applications

Fiber-reinforced ceramic matrix structural components have been calculated, fabricated and tested for high-temperature applications up to 1,800°C. They offer a reduced mass as well as a very low coefficient of thermal expansion, great stiffness and high strength. The materials used are SiC/SiC, SiC/C and C/C. The components measure up to about 400 x 900 mm. They can be fabricated in variable geometries (tubes, curved plates, shells with stiffeners...) and assembled by means of high-temperature-resistant bolts to building larger structures. The fields of application are numerous: brakes, thermal shields, turbine exhaust nozzles. (Ref 61)

### High-Precision Polymer Mirrors Reinforced With Carbon Fibers (CFRP)

The components of these mirrors are of polymer reinforced by carbon fibers, which provides them with a low coefficient of thermal expansion as well as a high strength. These two characteristics can be adjusted within a wide range of values by using various carbon fibers available in the market. The mirror segments are a 100 percent CFRP sandwich design; i.e., core included; with a mass density of 40 kg/m<sup>3</sup>, which gives an area mass of 10kg/m<sup>2</sup> for the complete mirror, including its accessories.

The surface finishing is obtained by a special replica technique. For a two-meter-diameter mirror, divided into 60° sectors, the reproduction fidelity, with respect to the master mirror, is better than 0.3 micron.

Because the mirrors are to function under high accelerations, all structures requiring great thermal stability and, at the same time, great mechanical strength is a part of the application possibilities. (Ref 62)

### Oxidized Ceramic Surface Coatings for Light Alloys

A particular method for obtaining optical surfaces on aluminum, titanium or other light alloys consists of coating them with oxidized ceramic. The process is particularly interesting when the intent is to obtain a black optical surface on titanium alloys without using varnish. With respect to the state-of-the-art, this method permits obtaining almost equal values of optical absorptivity and thermal emissivity. Furthermore, it is possible

to coat components of complex geometry, such as lens and objective frames. The coatings possess the following properties: long durability of optical characteristics, ideal isotropic optical behavior insofar as radiation reflections are concerned, great stability at temperature under vacuum. Fields of application: chip carrier in semiconductor technology, surfaces resistant to halides for chemical depositing under vacuum, absorbent layers in the infra-red for various measuring techniques. (Ref 63)

#### Ultra-Light Thermal Protection

This is a multi-layer shield intended to protect Hermes against radiation during its reentry into the atmosphere. The system is adaptable to a wide range of needs. Its main components are: ceramic layers reinforced by fibers provided with a reflective metallic coating having a surface density of  $35\text{g/m}^2$ , low mass density felts ( $20\text{g/m}^3$ ) to shim the radiation screens. These components can be assembled in appropriate insulated units. By reason of the use of the ceramic and (to a certain extent) metallic materials, the system is capable of supporting temperatures up to  $1,500^\circ\text{C}$  in corrosive environments.

Other than the protection against radiation flux, the insulation has great thermal-dissipation capacity which is appreciable when under impulsive-type thermal loadings, such as those anticipated during the 20-minute reentry of Hermes into the atmosphere. (Ref 64)

#### Shape-Memory Alloys

When their temperature is raised, shape-memory alloys have the faculty of recovering the initial shape they had prior to a mechanical transformation. This phenomenon is one of the astonishing thermomechanical properties associated with a reversible structural transformation which is produced between the temperature at which the specimen was shaped and that at which it regains its shape. It is possible to impart a *double-effect memory* to *single-effect-memory* alloys. This effect is obtained by an appropriate series of thermomechanical treatments called "Education": an object thus educated will be able to oscillate in a reversible manner between two stable-shape states corresponding to the high temperature and the low temperature limits. Aeronautics, automobiles, household appliances, toys and architecture are some of the fields of application of these alloys. (Ref 65)

#### Hollow Ball for Producing Structural Components

The process permits producing perfectly spherical small hollow balls, of organic or metallic material having a selected diameter between 2 and 7 mm. Their volumetric mass varies between  $100\text{ kg/m}^3$  to  $700\text{ kg/m}^3$  for the thickest.

A material is created by assembling these balls by gluing or by mixing. Its structure can be organized or random. This material exhibits characteristics for absorption of shock-induced energy, acoustical insulation and thermal

insulation. Lastly, its advantages are: isotropy, modularity, and formability. In addition to aeronautics, the applications involve ground-transportation vehicles and ocean-going vessels as well as building construction. (Ref 66)

#### Automated Device for Producing Composite Parts by Draping

The work station permits the cutting of the preimpregnated material, the positioning of the cuts, their draping and their compacting.

The cutting machine is a numerical control machine which uses the water-jet cutting principle. It is fitted with a device that permits removal of the lower separator automatically. The useful flat draping area is  $1\text{m} \times 2\text{m}$ . A system of two image-analyzing cameras monitors the cutting positioning and orientation operations as well as the removal of the separators. The automatic compacting station is located at the end of the assembly line. The overall process is controlled by a computerized program permitting the management of a "parts library," the "mixing definition" of several parts, and the elaboration of a numerical control program corresponding to this mixing. The innovation results in the diminution of management expenses (suppression of the templates) and a system perfectly adapted to producing parts of large and small dimensions. The applications involve all sectors where the shaping of composite materials requires a reliable and precise system capable of providing parts from preimpregnated unidirectional cloth materials. (Ref 67)

#### Arc-Plasma Burner With Split Tip

The arc-plasma burner incorporates a combustion chamber feeding a nozzle with a split tip. An electric arc, oriented parallel to the axis of the nozzle, burns in a steady manner, heating the gas up to a temperature of more than  $10,000\text{ K}$ . Fed with ceramic, metallic or thermoplastic materials, the burner discharges at high speed, making possible its use as a perfected plasma spray gun. For depositing uniform high-quality coatings, or as plasma flame welder.

The generators and the usual plasma guns are limited by the fact that their spray provides a fan pattern and has an approximate diameter of only 6 mm which limits the area covered by the gun at a given time. Furthermore, the high amperages require frequent replacement of the electrodes. This new plasma generator can be several centimeters long which allows the use of high voltages and, for this reason, low amperages thereby limiting electrode wear. It is possible to cover much wider areas with each movement thus permitting sweeping the area with a "brush stroke" while improving the uniformity of the coated surface and avoiding overlaps.

This new plasma gun will easily find applications in the coating of ceramic, metallic or even thermoplastic structures requiring protection against abrasion or corrosion.

The device itself can be used for thermal treatment of various material surfaces, including plastics. (Ref 68)

#### **France: Ministries Form Materials Council, Group**

*93WS0011B Paris COMPOSITES ET NOUVEAUX MATERIAUX in French 17 Sep 92 p 6*

["Creation of A Materials Orientation Council and a Materials Interministerial Group"]

[Text] It is with the purpose of orienting and coordinating government policy relative to research, development and industrial aspects in the sector of materials that the Ministries of Defense, Industry and Research have decided to create a Materials Orientation Council and a Materials Interministerial Group.

The Materials Orientation Council will instigate and activate studies and thoughts on the state of technology concerning materials; it will rule on the analyses presented to it; it will issue recommendations on the orientations to be followed. It will watch over the distribution of the research results, technology transfers and compliance with training requirements.

Fifteen individuals will be grouped within this Council. Belonging in the majority to the industrial world, they will be selected on the basis of their competencies and their responsibilities in this field of activity and will be named for three years.

As to the Materials Interministerial Group, it will ensure the coordination of the actions and the exchange of information on the activities and establishments under their charge. Based on the work of the Orientation Council, the Group defines and implements pluriannual programs relative to materials. It establishes rapid focusing of the public administrations and establishments on all specific problems concerning materials. With the goal of promoting concerted international policies, its role is to maintain contacts with foreign administrations and establishments, particularly European. This group includes representatives of the ministries in charge of Defense, Industry and Research. The Presidency of the group is exercised by annual rotation.

#### **German Subsidies, Priorities in Materials Research Described**

*93WS0032A Duesseldorf HANDELSBLATT in German 8 Oct 92 p 28*

[Article by Eberhard Seitz, Project Director of the Materials Research Center in Juelich: "Japanese Companies More Committed than Germans"]

[Text] HANDELSBLATT, Wednesday, 7 October 1992—Among the key technologies that ensure the competitiveness of important industrial branches are the production and further development of new materials. For that reason, in its materials research program the Federal

Ministry for Research and Technology (BMFT) has—since 1985—especially supported innovative joint projects in the fields: ceramics, powder metallurgy, metallic high-temperature materials and special materials, polymers and composite materials.

The following table indicates total federal funding approved since the onset of the materials research program up to, and including, 1991 (Material Research, BMFT Program, published by Materials and Raw Materials Research Project (Matfo) Management in the Juelich Research Center):

Approved Funding 1985-1991	
Material	DM (millions)
Ceramics	149.5
Powder metallurgy	71.2
High-temperature & special materials	113.9
New polymers	129.6
Composite materials	124.5

Special emphasis has been put on defining the division of work between industry and the scientific community (joint research). On the one hand, the scientific principles developed at the technical universities and the Max Planck Society and the more applications-oriented know-how of the Fraunhofer Society are used. On the other hand, momentum, innovative ideas, as well as market analysis and the potential of actually penetrating the German market are also taken into account. As a rule, the BMFT contributes about 50 percent of the total costs involved in these initial joint projects.

In the case of high-performance ceramics, the improvement of the structural properties (mechanical, thermal, chemical) in materials and components is the immediate focal point of attention, especially in the case of nitridic, carbidic, and oxidic materials. Since 1988, besides the optimization of their biomedical properties (bioactive, bionized mostly oxidic materials), the physical properties (dielectric, electronic, ionic, optical, magnetic) of these ceramics have been of special interest.

Like a leitmotif, the fundamental and applications-oriented material and process development run through the joint projects. The more basic science oriented projects provide a better understanding of the present materials right down to the micro- and nanometer size and are the foundation for the development of future materials, tailored to the constantly more demanding requirements in, for example, machinery and equipment manufacturing, and the power, environmental, information, and communication technologies. The more applications-oriented projects target in on improving the process of powder synthesis, body preparation, forming, sintering, fixing, machining, quality control, and component layout in order to demonstrate the reliability and

cost-effectiveness (with reproducible properties in component parts) as well as the overall intrinsic potential of high-performance ceramics.

Questions must be resolved concerning the avoidance of error and error tolerance by improving the breaking strength. First measures in this regard deal with the correct placement of the correct atoms/particles in the crystal lattice structure, i.e., process control in the nanometer/micrometer scale by controlling the surface chemistry and physics of the particles. This is true, for example, in the matter of improving the mechanical properties by dispersoid and particle reinforcement. It is also true with regard to improving the breaking strength by following nature's own model (biomimicry). A fibrous or multi-ply structure of this sort prevents the spread of cracks. Multicomponent, multiphase materials meet the multifunctional requirements profile of components and systems of microscopic size. The relationships between nano/microstructure and microscopic properties have to be deepened and fruitfully utilized in the development of materials and material-processing technologies.

#### "Intelligent Materials"

Moreover, further research must be undertaken in the field of "intelligent materials." "Intelligent materials" are those whose properties, e.g., strength, rigidity, and attenuation, change reversibly in the desired manner under different conditions of use, and which react to overloads with a degree of tolerance that prevents damage. Miniaturized sensor/actuator ceramics can, for example, help in detecting the onset of cracks in structural components as well as help in preventing the spread of cracks. A wide field has opened in this regard, namely, how to utilize physical effects like phase transitions and electrical and magnetic striction in materials science and technology.

These target-directed fundamental research fields in the materials research program are also supported by the "High-Performance Ceramics" priority program of the German Research Society (DFG). In the DFG the following three lines of research are receiving special attention: the underlying chemical and physical principles in the production process; constitution, structure, and properties; and structurally decomposed trace analysis. A more intensive exchange of information—involving both the exchange of results and the sharing of problems—should build more bridges between DFG and Matfo activities. In many aspects of the problem, DFG-supported institutes are actually partners in Matfo joint projects. This sort of "personnel union" is a sure way to facilitate the transfer of scientific and technical know-how.

It is and will remain the task of the more applications-orientated materials and processing offices to make the interdependence of the procedures from powder production to sealing, joining, and machining as well as their effect on the properties of the components cost-effective and reproducible on a technical scale. Remarkable

improvements in ceramic properties have been realized since the initiation of the materials research program in 1985 in the ceramic components used in engines and turbines. The engine valve emerged as a "leading component" against which the readiness of the process procedures to go into large-scale or series production could be measured. Even the Japanese had not yet marketed them. On the other hand, about 300,000 ceramic exhaust gas turbochargers had already been installed in vehicles. Both the United States and Europe, neither of which has initiated series production, clearly lag behind Japan in this application.

With comparable financial backing in R&D in high-performance ceramics, Japanese companies obviously have achieved more, and have pushed the commercialization, i.e., bringing potential users together with the producers on the market, more intensively. In future, R&D support in Germany will have to be more strongly oriented to preparing industry to commit technically ready products to the market.

#### Joint Projects Can Save on Costs

The greater readiness on the part of industry to engage in combined projects, i.e., horizontally joint projects, which would also include future potential competitors, involving metals and polymers, could also help limit R&D expenditures in ceramics and thereby result in a swifter (laboratory-technical university, institute-industry) technology transfer. The establishment of centers, as an indirect specific measure if need be, could help to test and demonstrate the process engineering on a semi-technical scale and thereby help to close the transfer know-how gap in the above-mentioned combined undertaking.

The cost-intensive processing of ceramics is an example. From such demonstration centers, many market incentives for small companies could be picked up and passed along.

Besides the BMFT's materials research program, there are other BMFT technology programs in which high-performance ceramics is being and has been promoted as, for example, in the physical technologies (high-temperature superconductors), power technologies (heat exchangers), microelectronics/microperipherals (sensors, actuators). The individual Laender (States) like Baden-Wuerttemberg, Bavaria, and North Rhine-Westphalia have also undertaken notable support activities on behalf of high-performance ceramics.

The international standing of the technology is an essential scale against which to evaluate the need for R&D support. If R&D problems can only be solved, or be solved better, i.e., swifter and more economically, in cooperation with European partners, then in future European cooperation will be supported with national funding within the framework of the COST and EUREKA initiatives.



### International Cooperation

Cooperative undertakings with the United States, Sweden, and Japan within the framework of the International Energy Agency (IEA) and with the six most important economic nations—the United States, Canada, Japan, Great Britain, France, and Italy, as well as with the Commission of the European Community within the framework of the Versailles Project on Advanced Materials and Standards (Vamos) extends far beyond the borders of Europe. Within the IEA and Vamos, procedures for characterizing and testing high-performance ceramics are tested for their suitability as international norms by means of international comparison measurements.

In these diverse ways, we hope to remove the technical obstacles preventing new materials like high-performance ceramics in from entering the world market.

### British Steel Developing Lightweight All-Steel Can

93WS0094P *Toddington NEW MATERIALS INTERNATIONAL in English Oct 92 p 4*

[Article: "United Kingdom: British Steel Develops the Ultimate Can"]

[Text] According to British Steel Tinplate, its Ultimate Can development marks a breakthrough in steel packaging technology that is set to revolutionise the beverage sector in the next two years.

Developed by British Steel Tinplate, in association with Hoogovens BV and Rasselstein AG, the Ultimate Can is an all-steel can, which is predicted to be 30 percent lighter than the steel cans of today, yet maintain its position as the strongest can in the market place. The initial phase of the project has been accomplished on schedule.

Set to be in full production by mid-1994, the all-steel can features a number of major developments, each offering additional benefits to can makers, fillers and the consumer in terms of cost, quality, environmental friendliness, safety and convenience. The most significant of these developments are lightweighting, the development of Ecotop and necking in.

British Steel Tinplate is leading the project to lightweight steel beverage cans by 20 percent in the first half of 1993, and by a further 10 percent by mid-1994 thus producing the Ultimate Can. This lightweighting means a total reduction in starting metal thickness from 0.27 to 0.22 and British Steel Tinplate is currently researching the maximum thinness of the walls that can be achieved with no compromise on can strength characteristics. Only steel has the flexibility and the inherent strength to continue the lightweighting process to this degree without the problem of dome reversal or fragile walls, it is claimed.

Ecotop, the non-detachable Steel Easy-Open End is a key component of the Ultimate Can. It is simpler to manufacture, more energy efficient, yet considerably less costly than the traditional stay on tabs. Ecotop is also environmentally friendly, as steel is recyclable, and safer for the consumer as the new design is also tamper evident.

By mid-1992, British Steel Tinplate and its partners claim they will meet the requirements of the market for a neck diameter of 0.25 inches if required, thus reducing can weight and metal content further. This process will not compromise any of the usual design aspects such as a smooth neck, good seaming, strength, stackability and dome reversal resistance.

### AEROSPACE

#### Impact of ESA's Proposed Budget Cuts Discussed

##### Hermes Bears Brunt

92WS0808A *Paris LE MONDE in French 10 Sep 92 pp 1, 9*

[Article by Jean-Francois Augereau: "Hermes Scaled Back"; first paragraph is LE MONDE introduction]

[Text] After a call by member states for a first wave of cost-cutting measures, the European Space Agency proposed a new squeeze in expenditures on Tuesday, 8 September, in Paris. The primary victim: the Hermes spaceplane.

In the end, the cost of German unification and the prospect of a French budget deficit that may reach 200 billion French francs [Fr] in 1993 got the better of Europe's ambitions in space. Indeed, during his presentation of the European Space Agency's long-term plan on Tuesday, 8 September, its general director Jean-Marie Luton proposed that expenditures be reduced by 700 billion accounting units (about Fr4.9 billion) to representatives of ESA member states. He also suggested that the program, which involved a financial commitment of 23 billion accounting units through the year 2000, be trimmed to 22.3 billion.

What many had feared for the last several months has thus come to pass—proof, if any is needed, that when Europe's second-largest space moneylender, Germany, sneezes, the entire European space program gets a cold. It is thus a low-profile observation to say that, except for the Ariane 5, Europe's future heavy launcher whose development is moving along at a brisk clip, all the ESA's other star programs will be feeling the pinch of budgetary austerity again. Those not spared include the Hermes spaceplane, the Columbus space station, the high-speed DRS telecommunications satellite, earth observation, and microgravity.

Germany had already sounded the alarm in November, 1991, in Munich, where it reined in the enthusiasm of a

France too accustomed to acting as the driving force of European space collaboration, and certain that it could push through acceptance of its Hermes spaceplane program. Given the cost—7.32 billion accounting units, or some Fr52 billion, 43.5 percent to be underwritten by France and 27 percent by Germany—Munich dug in its heels.

The Munich ministers' summit was to have led to a several-year-long commitment to an ambitious Hermes and Columbus space program. Instead, it was cut short, ending with "programs that were cut into snippets," funded for just one year, and a date for a meeting in late 1992 in Spain to decide the next step. Despite the disappointment of some, everyone loudly proclaimed that the essentials, and especially European union, had been preserved.

That is hard to believe, when hopes for a far-reaching plan have suddenly given way to an inchworm policy, which may or may not produce a big leap forward some day. Certain manufacturers were openly bitter, saying that the worm was in the apple and that by trying to cut too much, it would soon become impossible to do anything more with Hermes. The European Space Agency went back to its drawing board in January this year, and tried once again to find less costly scenarios, notably by seeking possible ways to collaborate with the countries of the former Soviet Union.

#### A Cut-Rate Demonstrator

In May, just six months before the conference of space ministers scheduled in Grenada, Spain, two months from now, Mr. Luton unveiled the Agency's new long-term program. The French spaceplane was again scaled back. Indeed, the ESA proposed replacing Hermes as defined by the National Center for Space Studies and Euro-Hermespace manufacturers with a scale-one demonstrator christened X-2000.

The equipment on this highly simplified version of the craft was to be stripped down to essentials for a short automatic flight at the turn of the century. The version would serve as a springboard for a second phase of the program, which would ultimately build the real Hermes and send up a manned flight well after 2005, instead of the original November, 2003, mission date talked about before Munich. At the same time, an important portion of the Columbus program, which called for the construction of a manned laboratory called the APM, to be attached to the American space station Freedom, was scratched. The project in question was the construction of the MTFF, an autonomous module that could be visited by Hermes. Its development was postponed sine die.

Some were hoping that the deep budget cuts and prolonged delays would be the end of it. But the stubborn rumor mill planted so much doubt that the French minister of research and space, Hubert Curien, declared in August, "I was Hermes's midwife. Don't look to me to be its gravedigger." He probably won't be. But a close

look shows that, once again, Hermes has had its wings seriously clipped. The new proposals Mr. Luton presented Tuesday, 8 September, clearly mention a new 235-million-accounting-unit reduction in Hermes expenditures, or savings of about 5 percent between now and the year 2000. This puts the kibosh on a spaceplane or even a scale-one demonstrator for the immediate future.

#### Studies and Technological Program

The current preference is for a three-year commitment (1993-95) to a scaled-back first stage involving systems studies and a technological program. "Is Hermes dead?" asks a specialist. "No. The concept is still a good one." "But," he admits, "some of the logic of the project is lost with the new proposals. We are no longer driven by a project, but invited to define it. That makes holding down costs and meeting timetables and specifications less urgent."

This raises the question of whether the weaker impetus of such a program may not make it more vulnerable, despite the ESA's attempts to compensate for the project's limited ambitions. The Agency is actively discussing the possibility of some day developing Hermes and giving it a new "target," the space station Mir, with the Russians. It is also talking with the Americans about building a rescue vehicle—more a capsule than a shuttle—for the American station Freedom.

Whatever the case may be, Hermes is not the only program to suffer from the financial difficulties of the European states. The Columbus program, already amputated of its MTFF component, is being cut by an additional 150 million accounting units. This puts a damper on the ambitions of another segment of the program, the polar platform. Likewise, microgravity science, which involves the manufacture of materials in space and certain life-sciences experiments, is losing 140 million accounting units.

Though Munich considers earth observation a priority, the program is losing 128 million accounting units and has been scaled back to only two missions. One is a polar platform, Envisat-1, to be launched in 1998, and the other is another platform—Metop or Metoc—to be placed into orbit around 2000. Finally, the high-speed DRS telecommunications program has been staggered over time. Only the launch of its presatellite Artemis and its Silex laser telecommunications system on one of the first Ariane 5s has been scheduled for the near term.

So, the future of the European space program and of Hermes, which has lost quite a bit of its content, looks clouded. Hermes now bears a striking resemblance to the famous technological program that the Germans wanted to replace it with last year on the eve of the Munich meeting. It must be a bitter pill for Hermes's promoters, though some of them hope for an improvement in three years, when financial pressures ease as the needs of the Ariane 5 program decline. Let us take it as a sign, as minister Hubert Curien does.

In an embarrassed communique published Tuesday evening, Mr. Curien says, "A man in space is one of the foundations of France's policy in the European space programs. (...) Within the framework of those programs, France will strive to maintain the technological and industrial assets [it] gained during the first phase of the Hermes program, and to undertake the continuation of Hermes by opening it up to broader international cooperation and maintaining the goal of a future European manned transport vehicle."

What will the actual outcome be? Two months will not be too long for the governments and teams of the European Space Agency to spell out Mr. Luton's proposals, with an eye to the Grenada ministers' conference next 9 and 10 November.

### Cooperation With Russia Foreseen

92WS0808B Paris LE MONDE in French 11 Sep 92  
p 22

[Article by Jean-Francois Augereau: "The European Space Agency Looks to Russia for Salvation"; first paragraph is LE MONDE introduction]

[Text] Mr. Jean-Marie Luton, the general director of the European Space Agency (ESA), confirmed a rollback in Europe's space research ambitions (see LE MONDE, 10 Sep) on Wednesday, 9 September, in Paris. One of the programs that will suffer the most from the budget shortfall is the spaceplane Hermes. With the future of Hermes in mind, Mr. Luton said that Europe was considering teaming up with Russia to develop a system for transporting man in space as quickly as possible.

Europe's space program has been put on a strict diet. There is no mistaking that the proposals of the ESA's general director, Jean-Marie Luton, amount to a rollback of Europe's ambitions. It is true that the sums saved—between 700 and 800 MUC (million accounting units), or about Fr5 billion—do not endanger the agency's existence. The ESA still has a 1993-2000 budget of some 22 billion accounting units. It is also true that programs such as the Ariane 5 heavy launcher, whose first flight is scheduled for 1995, or those related to scientific activities and the development of telecommunications, have not been affected by the wave of austerity measures.

On the other hand, headliner programs involving man in space have been scaled back<sup>1</sup>, under pressure from each country's finance minister. As for the planned Hermes spaceplane—firmly promised by the French—it loses a bit more of its substance each day.

The fact is, the pressure of budget squeezes makes the immediate need for a European vehicle to transport astronauts seem less clear. From there it is only a step to settling for the modest three-year program built around a series of systems studies and a technology program that is now being proposed for Hermes. It is a step that the Europeans and French would rather not take. Consequently, Jean-Marie Luton is now proposing that Europe

quickly establish ties with the Russians to create a future Russian-European transport system based on the design that was developed for Hermes.

### Three Flights Aboard Mir

The next three years of research will not be too many to prepare this "Hermeski," which is intended to service Russia's future space station. The current station, Mir, has reached the end of its life, and the first elements of its successor Mir-2 could be launched starting in 1996. According to Mr. Luton, Europe may participate in the program by supplying a few subsystems. But it may also go farther by developing jointly with the Russians the famous new spaceplane and space station that will pick up where Mir-2 leaves off in the early 21st century.

It is a daring gamble. For although no one disputes the Russians' technical lead in a number of space fields, it will be undeniably difficult to collaborate on a program of such magnitude with a country whose currency is far from stable, whose financial resources—unless a barter economy is set up—are fuzzy to say the least, and whose administrative structures are still shaky.

To be continued, then. There is little hope, however, that firm commitments will be made between Russia and Europe prior to the meeting of ministers to decide Europe's future space policy in early November in Grenada, Spain. Be that as it may, the European Space Agency is anxious to stay the course on manned flights, despite budgetary trends that run counter and in keeping with the intentions of its member states. It has therefore decided to begin negotiations with Russian authorities to perform a series of three flights aboard the Mir station.

The first may take place in late 1994; the second, which would include a space walk, would occur a year later. The last and highly ambitious one, which is expected to last six months, would be executed in late 1996. "That would allow us," says Mr. Luton, "to better prepare our astronauts for their future space missions." Nothing has been signed yet, but each of the two parties is turning on the charm to push the plan through. The one to shore up programs that have shrunk; the other to pick up a few dollars and salvage hardware and rigs that are unequaled in the world.

As proof of its good faith and interest in such a collaborative project, the ESA is prepared to award the Russians a series of specific contracts worth 100 million accounting units. The latter are above and beyond those worth six million accounting units that were already signed at the beginning of the year.

### Footnotes

1. The amount saved over the long-term plan the European Space Agency presented before the summer would be, grosso modo: 70 MUC on the general budget; 128 MUC on earth observation; 140 MUC on microgravity studies; 150 MUC on Columbus; 231 MUC on Hermes; and 150 MUC on certain technology contracts.

**European Students Design Remote Sensing Satellite***92WS0830A Paris AFP SCIENCES in French 3 Sep 92 p 8*

[Unsigned article: "Scientific Satellite Designed by European Students"]

[Text] Paris—A communique from the European Space Agency (ESA) announces that an earth-observation satellite has been designed by 20 technical sciences students from 10 European countries, from Portugal to Poland, as part of a "workshop" organized with support from the ESA.

This two-week meeting was initiated by the European Association of Aeronautics and Astronautics Students (EUROAVIA) and conducted on 3-14 August at the European Center for Space Research and Technology (ESTEC) in Noordwijk, Netherlands, with the objective of providing the students with an intensive practical training toward the completion of their university studies.

It was focused on the design of a scientific satellite, named Ecowatcher, that could complement ESA's future polar orbit mission, POEM-1. According to the communique, at the end of the workshop, the students together with specialists from ESA/ESTEC and the aerospace industry, reached the preliminary design stage. With its main instrument, a sweeping absorption spectrometer with image gathering for atmospheric cartography, the satellite could monitor various atmospheric processes from its 41° orbit.

The data it would collect on trace gases in the lower layers of the atmosphere (troposphere and stratosphere), could help scientists better understand the atmospheric chemistry above the tropical and subtropical regions that determine the planet's climate.

**Riesenhuber Expects Hermes Spaceplane to be Dropped***93P60001A Duesseldorf HANDELSBLATT in German 29 Sep 92 p 1*

[Text] Federal Minister of Research Heinz Riesenhuber expects the European spaceplane Hermes to be abandoned during the council of ministers conference of the European Space Agency (ESA) in November in Grenada, Spain. Riesenhuber said in Bonn that, for Europe, the building of the spaceplane could not be financed in its planned form, whether manned or unmanned. Hermes has become more and more expensive and does not accomplish as much as originally estimated, Riesenhuber said. One can also expect the cancellation of the intermittently manned tiny space station, the MTFF (Man-Tended Free Flyer). "That is indeed a painful matter, because the MTFF was a fascinating project," said Riesenhuber. On the other hand, participation will continue in the Freedom international space station with the European Columbus module, he said.

**CNES Head Discusses Hermes Future***93WS0020A Paris AFP SCIENCES in French 17 Sep 92 p 7*

[Unattributed article: "The 'New' Hermes Means 'a Difficult Stage of at Least Two Years,' According to CNES Head"]

[Text] Kourou—After the European Space Agency's (ESA) proposal to try to cooperate with the Russians in making the "new Hermes," the CNES [National Center for Space Studies] president, Mr. Jacques-Louis Lyons, acknowledged that they "would have to go through a difficult stage of at least two years."

"It is obvious that whatever is done by, or jointly with, the Russians will be taken away from the French industry," he said in Kourou where he had come to watch the launching of the 53rd Ariane. "If we give up the planned Hermes project, we should make sure that our industrial teams and engineers are not 'demotivated.' We shall have to consider reorganizing the CNES too. The CNES's favorite scenario—which is still the one I prefer—was to build Hermes, to go either to a Russian station such as Mir, or to a U.S. station. But if we can no longer make Hermes, let's do better, quicker, and cheaper through extensive cooperation."

"Throwing back into question" the Hermes program is a "serious blow" for European space cooperation, according to the General Confederation of Labor (CGT) which believes that "postponing, or even giving up" the spacecraft project would affect the French aerospace industry and France's scientific potential as a whole.

In a communique published on 11 September, the CGT estimated that implementing this decision would affect "the jobs, know-how, and technological resources" that should constitute "a national priority." "Certainly," the CGT went on, "there is an ongoing debate on the relevance of such projects. In any case, the lack of continuity and consistence in programming, financing, and partnership leads to considerable investment waste and to the weakening of scientific relations in Europe. This decision, made on the eve of the Maastricht referendum, shows that European integration, as it is currently implemented, is inadequate to ensure fruitful cooperation."

For his part, the French minister of overseas departments and territories, Mr. Louis Le Penec, stated on 11 September that Hermes would take off from Kourou, as initially scheduled: "Launching operations will indeed take place from the 'European space temple.' This should reassure Guiana as to its future in this all-important sector."

**Eutelsat 2-F4 Set Into Service***93WS0020B Paris AFP SCIENCES in French 24 Sep 92 p 8*

[Unattributed article: "Eutelsat 2-FE Set Into Service"]

[Text] Paris—Eutelsat 2-F4, the fourth second-generation satellite of the European Satellite Telecommunication Organization (Eutelsat), which was placed in orbit by the 51st Ariane rocket on 9 July, was set into service on 18 September.

Eutelsat 2-F4 has reached its final position on geostationary orbit, at 7° longitude east, above the Gulf of Guinea, next to Eutelsat 1-F4 which it will replace. During the next two weeks, business, television, and radio services will be transferred from the old to the new satellite. At the end of that period, Eutelsat 1-F4 will move to its new position on orbit, at 36° longitude east; it will be used essentially for the Euteltracs land mobile service. In addition, next January the services of the European Radio-Broadcasting Union (UER) will be transferred from Eutelsat 1-F5 to Eutelsat 2-F4.

Built by a group of European manufacturers, with the French Aerospatiale as a prime contractor, Eutelsat 2-F4—thanks to its enhanced broad beam—provides more extensive coverage (beyond Moscow) of Eastern Europe than other satellites of the Eutelsat-2 series, in addition to its coverage of Western Europe. Like its "siblings," however, it is equipped with 16 repeaters which can operate simultaneously: seven with a large (72-MHz) Ku-band, and nine with a narrow (36-MHz) Ku-band. It has an eight-year service life.

#### **Efforts To Save Reduced Hermes Seen Doomed to Failure**

93P60022A Duesseldorf *HANDELSBLATT* in German  
12 Oct 92 p 18

[Text] Paris—In a last effort, the European space industry is attempting to prevent a too severe cutback in the Hermes program. According to the plans of the European research ministers, the small space transporter for three astronauts will probably be downgraded by a mere technology program. The industrial consortium Eurohermespace, which was founded expressly for the mini-shuttle, has been trying to establish a last line of defense during a press conference in Paris.

But the fate of the small space shuttle is probably sealed. For one thing, at a cost of about DM8 billion, it is considerably more expensive than originally planned. On the other hand, its performance has dropped greatly during the course of development. In addition to the three astronauts, it is supposed to carry only about a ton payload. This makes it easier for politicians to cancel Hermes and relieves the financial problems which many ESA [European Space Agency] members have in any case. Germany, in particular, must save money, but there are also financial problems in France and Italy.

Of course the space industry in these countries regrets this very much and points to the endangered jobs if such a large, elaborate program like Hermes is canceled or greatly reduced. Deutsche Aerospace (DASA) has just announced a personnel cutback of 10 percent. On the

other hand, Eurohermespace stresses the loss of technological ability which is threatened by the cancellation of Hermes. "Industry wants this spaceplane, Europe needs it, and we cannot just write off the approximately DM2 billion which has already been invested in this program," emphasizes Johann Schaeffler, general director of Eurohermespace.

In the opinion of the involved industries, a solution is offered by the Hermes-X2000 project, an unmanned spaceplane of only 16 tons which could later be expanded. In this way the involved European space industry could safeguard its investments and use them as a basis for further activities.

But not even the unmanned Hermes will probably have a chance when the research ministers of the ESA countries meet in Granada, Spain, in mid-November to discuss the future of the European space program. Hermes-X2000 would still cost DM5 billion, and that money is not available either, at least not on the German side, as Minister of Research Risenhuber recently stated in Bonn.

The last hope for the European industry is space cooperation with Russia, which after all has a lot of experience with building manned space vehicles. But it is rather doubtful whether one can really save money in the development of Hermes, even with Russian help.

On the whole, the status of European autonomy in manned spaceflight has become much more gloomy; this is also clear from the Eurohermespace press conference. And after the now planned three-year pause for reconsideration, it will probably not look much better in terms of politics and finances. But the responsible space managers issue warnings: "Europe needs its own access for its astronauts in earth orbit. And what we don't accomplish now in achieving this goal, we will have to pay twice or three times as much for, 15 or 20 years from now," admonishes Werner Heizmann, the DASA head of space travel.

#### **French Space Minister Defends Hermes Project**

93WS0040A Paris *AFP SCIENCES* in French 1 Oct 92  
pp 11-13

[Article entitled: "Budding Franco-German Controversy on Hermes"]

[Text] Bonn/Paris—A statement by a spokesman from the German Ministry of Research and Technology has sparked the beginnings of an apparently groundless controversy between the Germans and the French this week concerning the Hermes spaceplane.

Rainer Jansen declared on 29 September, that the German government considers the Hermes project, whether manned or not, unfinancable at this point. The spokesman added that Minister Heinz Risenhuber has estimated the project would be "too costly" no matter which version is selected.

Two days later, French Minister of Space and Research Hubert Curien categorically affirmed that Germany "is not burying Hermes." Mr. Curien explained that a slight exaggeration of reflections on the space programs had led the German press to attribute to Mr. Reisenhuber remarks that were just the opposite of what he actually said.

Mr. Jansen sees Mr. Reisenhuber's position as a "hopeful starting point" that may lead to a "consensus," despite the "predictable difficulties" it will raise during the European Space Agency's (ESA) conference of ministers in Grenada in November. The [German] ministry thinks that budget problems especially will push the ESA to begin "a three-year period of reflection," to adapt itself to the new geopolitical realities. Under the circumstances, the German ministry believes the main problem to be overcome on 9 and 10 November in Grenada is the predicament of the smaller countries, some of whose industries are deeply involved in Hermes subprojects and who expect compensation.

The spokesman added that the German minister is thinking about replacing Hermes with an "unmanned transfer vehicle," an emergency transporter, or in the longer term, Germany's Sanger program for a suborbital craft borne by a conventional plane at an altitude of 10 km.

Magnified by the German press, the spokesman's remarks suggested that haggling between Bonn and Paris would be keen. France supports the planned spaceplane, while Germany is an advocate of the Attached Pressurized Module (APM) laboratory, to be docked at Europe's Columbus module. The outcome of both will depend on the fate of the American orbital station Freedom. But the day before, Mr. Curien had expressed "optimism" based on his recent conversations with the German minister. "Grenada is looking more hopeful than Munich," he said during comments on the latest proposals adopted by the ESA council on 9 September<sup>1</sup>.

At the November 1991, Munich conference, the ministers broke with tradition by committing themselves for one year only, instead of adopting programs. They asked the ESA to explore the possibilities of international collaboration, especially with the Russians, on account of the financial difficulties of European countries.

The latest ESA council plan, which will be submitted to the ministers in Grenada, proposes savings of ECU800 million between 1993 and the year 2000, out of a total of 23 billion. Proposed cuts include 231 million on the Hermes program, 150 million on Columbus, and 140 million on the Microgravity program. At the same time, the plan calls for an in-depth three-year study with the Russians on how to "reorient" the Hermes program and bring Europe into work on the future Russian Mir-2 station. The minister points out that the plan results in "savings of roughly 5 percent over earlier ESA proposals (2 July, 1992), a stable budget in 1994-95, and moderate

growth thereafter" for the 1993-2000 period. After 1994-95, stressed Mr. Curien, Europe will be relieved of its heavy expenditures on the Ariane 5.

The minister concedes that the new ESA plan "sharply scales back goals" compared to the La Haye program, [cutting] about 20 percent of the spending for the 1987-2000 period. But part of the program has already been carried out. The new plan still enables Europe to pursue manned space projects, without which it would be a "minor Europe," reduced to launching Arianes. But the ESA must redefine the spaceplane program, which no longer has a European craft, but only Freedom and perhaps the Mir, to visit. (The MTFF program was eliminated two years ago, at the Germans request.)

Mr. Curien and Mr. Reisenhuber agree that "Europe must take advantage of the Russians opening up to the outside world" to build the spaceplane with them. The Russians need a crew transport capability less "brutal" than their descent capsules. The ESA must also discuss with the Americans its contribution to the operation of Freedom via Columbus. The maintenance expenses Europe will have to bear are estimated at ECU250 million a year, for which it receives nothing in return—not a very satisfactory deal in Mr. Curien's view.

But will the countries of Europe be able to back the new plan financially? As far as France is concerned, Mr. Curien emphasized, the space item in the 1993 budget will remain "substantial," and the budget of the National Center for Space Studies (CNES) will grow. Germany's 1992 space budget is expected to remain more or less stable (minus inflation) in relation to 1991's.

The French minister's current worry is Italy, which is struggling hard financially. It may also be necessary to revise the quotas of small contributors, who are involved in Hermes subassemblies, in the new plan. Moreover, Mr. Curien added, the Hermespace company will not be dissolved—its personnel will just be cut back.

On 1 October, Mr. Curien said in a footnote to his presentation of the Research Ministry's budget that his German colleague's ministry had reassured him after the news that Bonn was reluctant to finance Hermes was published. "What the Germans want is to think about it," stressed Mr. Curien. "We are no longer in the competitive situation of 1985, when Hermes was born, and when we set a timetable for making Europe one of the great space-traveling nations, with our own means of space travel."

"I am still a staunch defender of Hermes, but in order to use it, we have to go somewhere with it. Despite their problems," Mr. Curien added, "I am convinced that the Russians will be able to continue operating their orbital Mir station. Plans for the second-generation Mir-2 station are in the works. To get there and back, the uncomfortable ships they have used until now must be replaced, and I believe we have a craft (in Hermes) that will do the job."

#### Footnotes

1. See AFP SCIENCES No. 838, 10 September 1992, p 5.

### CNES Unveils Planet Exploration Vehicle

93WS0040B Paris AFP SCIENCES in French 1 Oct 92  
pp 13, 14

[Text] Toulouse—The vehicle sports four driving wheels, a tubular chassis, and extendable axles. It is known for its slow traveling speed—less than one kilometer an hour—and high IQ, and weighs in at about 450 kg. It is called the VAP, the Unmanned Planetary Vehicle, and plans for it were presented on 28 September, in Toulouse at an international symposium on the "Design, Missions, and Technologies of Mobile Planetary Vehicles."

"The VAP will be a spacecraft, all-terrain vehicle, and robot rolled into one. Its first mission will be to explore the planet Mars around the year 2001, and later to explore the moon," explained officials of the National Center for Space Studies (CNES). The CNES has been working since 1989 on the project, which has just entered the crucial phase of configuration design. That task has been delegated to a manufacturing consortium composed of Aerospatiale, Alcatel, and Sagem, among others.

The VAP will be a highly "intelligent" spacecraft, indicated a CNES project official, Michel Maurette, since it will not only have to observe, detect, and evaluate, but make decisions and implement them without intervention from earth as well. Use of the VAP will be a key phase in the scientific exploration of Mars, of which current maps offer only an overview. The decision on which overall design to choose is expected in 1993.

The sessions on mobile planetary vehicles were held between 28 and 30 September. They were followed by a second symposium, "Space Applications of Artificial Intelligence, Robotics, and Automation Science," which was organized jointly with the German and American space agencies (DARA and NASA) and three Japanese organizations (ISAS, NASDA, and NAL). It will last until 2 October.

### DASA's Problems With Lack of Orders, Politics Noted

93WS0048B Duesseldorf HANDELSBLATT in German  
15 Oct 92 p 31

[Article: "Schrempp: The Situation Can Only Get Better"]

[Text] HANDELSBLATT, Wednesday, 14 Oct 92 wh FRANKFURT/M—"For the moment, nothing is working for us," opined Juergen E. Schrempp, chairman of the board of Deutsche Aerospace AG (DASA), at a meeting with journalists in Frankfurt. He identified the problems facing the aviation and space companies as (1) the U.S. dollar's low exchange rate, and (2) the dwindling defense orders. The DASA chief executive officer drew some consolation from the "probability curve," according to which things can only get better.

On the matter of reducing the work force in the company by 7,500, announced last week, Schrempp said that this will occur over a two and a half year period. However, the recently taken decision against the "Jaeger 90" aircraft has not yet been taken into account. An examination also has to be undertaken of the many, dispersed sites of the company's aviation and space facilities. DASA especially hopes to avoid dismantling any of the four active company sites in eastern Germany, mostly around Dresden.

Schrempp believes that Europe needs a new fighter aircraft, despite the changed defense situation. In any event, a European development would certainly be better than a "bought-from-the-shelf" U.S. aircraft.

### New Operating Conditions Have to be Set by the Government

Since the rules of the game are established by the government, industry needs firm operating conditions and especially fixed prices. It is quite possible that what was lost in the military sector could quickly be replaced by traffic control systems, processes to utilize regenerative power sources, and other innovations.

As for the Airbus, Schrempp noted that although industry needed 20 years to do the job, today this aircraft is world class and is making money. The new long-range version of the Airbus is without question superior to the Jumbo. Its roughly 130-seat smaller capacity, can only be considered an advantage, given the unsatisfactory load of most aircraft. Nevertheless, Dasa is also giving some thought to a future jumbo-sized aircraft which would have a seating capacity of 600-800. However, Schrempp observed that such large aircraft would require a change in the infrastructure of the air terminals it will use.

### Interesting Contacts With Some Engine Producers

For projects smaller than the large aircraft, Europe will have to come to a consensus. DASA has therefore been negotiating with the Fokker company and seems near an agreement. However, the Netherlands is "certainly not the easiest European country in which to find a majority decision."

With regard to helicopters, Schrempp is very satisfied with an alliance formed with France's Aerospatiale, according to which the figures should be in the black. DASA has also have "very interesting contacts" with various engine manufacturers.

Schrempp is absolutely convinced that the merging together of the German aviation and space industries was correct, otherwise the industry would have already



died in Germany. On the other hand, Schrempp concluded: "Large companies, too, sometimes have to be broken down into smaller units and new entrepreneurs cultivated."

### **Sweden Plans for Astronomical/Environmental Space Telescope**

*93WS0063A Stockholm NY TEKNIK in Swedish  
24 Sep 92 p 5*

[Article by Sven-Olof Carlsson: "Sweden's Eye in Space"—first three paragraphs are NY TEKNIK introduction]

[Text] Swedish astronomers and environmental researchers will have their own eye in space within a few years.

The Space Administration will send up an advanced telescope in the Odin satellite.

The unique reception technology is now being developed at Chalmers.

The Space Administration is requesting 240 million kronor in the new Swedish space budget for a combined astronomical and environmental satellite. A launch date in 1996 is planned. Its instruments will be able to look out at distant stars as well as in toward the outer layer of the earth's atmosphere.

The instruments will work within a previously unexplored wavelength area. They will chart the presence of water vapor, oxygen and various chlorine, carbon and nitrogen oxides as well as ozone both on remote stars and in the earth's atmosphere.

The measurements are essential to enable astronomers to explain how the stars were formed from cold interstellar clouds and to give atmospheric researchers greater insight into the chemical processes and transport mechanisms that govern the ozone balance.

"Odin will be our first satellite with triaxial stabilization. Viking and Freja have been rotated to maintain their position in space (spin-stabilization)," said department chief Per Nobinder of the Space Administration.

According to plan, Odin will travel in a circular orbit at an altitude of approximately 600 kilometers. The main instrument will be a telescope. It will be supplemented with an optical spectrograph.

The telescope works with wave lengths in the sub-millimeter area. It will have an advanced receiver technology developed by researchers at the Institute of Technical Electronics at Chalmers University in Goteborg.

In the past, reception of such signals was undeveloped and not available for use in space. The research competence in Goteborg is a basis for the project and a key to finding suitable cooperating partners.

Canada and France have shown great interest, according to the Space Administration. The administration is hoping for a decision from one or both of these countries by the end of the year.

The Space Administration would prefer to keep 70 percent of the project in this country. The Swedish Space Corporation, Saab-Ericsson Space and FFV [National Industrial Corporation] Aerotech and others have good space qualifications. With Odin this can be maintained and developed further.

"The work on the Odin satellite is in an advanced definition phase just now," said Nobinder. "We are now looking at the cooling of the instruments and the possibility of launching Odin with Pegasus, among other things."

The privately financed American Pegasus carrier rocket starts from the wing of a transport plane, a considerably cheaper technique than launching a rocket from the ground.

"The problem with the Pegasus is the small diameter. It limits the diameter of the satellite's reflector to 1 meter, the smallest we can consider," said Nobinder.

### **Europesat 1 Contract Awarded to Matra Marconi-Space**

*93WS0094H Paris LA LETTRE HEBDOMADAIRE  
DU GIFAS in English 24 Sep 92 p 1*

[Article: "MATRA MARCONI SPACE: Prime Contractor for 'Europesat 1'"]

[Text] The European Telecommunications via satellite organization Eutelsat has chosen Matra Marconi Space to build its Europesat 1 satellite and has already authorized work to start. The contract involves a direct 14 channel TV and radio satellite to have a lifespan of 12 years to perform in French and German. The Europesat 1 will weigh 2110 kg and employ the Eurostar 2000 operational platform made by Matra Marconi Space and BAe. The platform will carry a payload to be made by ANT Space (Bosch Group). Matra Marconi Space based its technical offer on the Eurostar made by GIE SatCom International (Matra Marconi Space + BAe). It is one of the most modern platforms available on the international market, already proved in orbit with the Inmarsat 2, Telecom 2 and, more recently, the Hispasat. It is well adapted to existing launching capacities and offers a lifespan of at least 10 years for telecommunications and television satellites, with ramp weights of 1200 to over 3000 kg and the ability to orbit payloads of over 430 kg, 4 kW and beyond. This is the 14th Eurostar platform ordered. Including the Hispasat 1, successfully orbited on 10 September 1992, seven Eurostar telecommunications satellites are presently in orbit. The proposition of Matra Marconi Space is based on solutions already proved in space. This will make it possible to build the system in 24 months including integration, but excluding launch tests and orbital testing preceding official



launching around the end of 1994. This new contract, following close on the heels of the Koreasat makes 13 space telecommunications programs being handled by Matra Marconi Space. The company (51 percent Matra, 49 percent GEC Marconi) employs 3100 persons and had an annual revenue of Fr4.82 billion in 1991. Order books stand at Fr8 billion and to date over Fr11 billion worth of orders has been booked.

## AUTOMOTIVE INDUSTRY

### New Materials, Methods in European Auto Production

92WS0838B Paris INDUSTRIES ET TECHNIQUES  
in French 11 Sep 92 pp 49-51

[Article by Murel Scherer: "Methods, Materials, and Machines That Power Advance of Automobile Production"]

[Text] Automation of production facilities continues, the laser is living up to its promises, fault analysis has been fully tried and tested, and new plastic and metallic materials are seeing the light of day. The car builders and equipment manufacturers are fine-tuning their production systems. In a nutshell:

- Plastic co-injection has now been adapted to the manufacture of automobile parts.
- A titanium steel reduces the cost of manufacturing forged steel crankshafts by 13%.
- Surface treatment by excimer laser has yet to be debugged.

In order to offer the consumer the most beautiful, the most efficient, the least pollutive, the safest cars, the automobile manufacturers are putting all the latest technological achievements to work. Innovations abound on cars—new materials, onboard computerized and electronics systems, antipollution devices, etc.—as well as in the car manufacturing plants: laser cutting, clean-room methods, etc. The International Symposium on Automotive Technologies and Automation (ISATA)\*, held just before summer, took stock of the most important of these developments. Herewith are those we have selected:

#### Heat-Resistant Plastic

It is hard and offers very high resistance to high temperatures. But that is not all. It also combines good dimensional stability with excellent aesthetic qualities after molding. These advantages make it a choice candidate for the realization of automobile components: structural elements and interior and exterior parts. It is Stapron S, a new amorphous plastic material. The automobile manufacturers are already finding this polymer attractive. To the point that its developer, the DSM company, plans to move, in 1993, from a test site capable of producing 600 tons a year to a full-fledged plant capable of producing 20,000 tons a year.

### Sandwich Pieces in Single Press Operation

Two Italian companies, Himont and Commer, have teamed up to reexamine and improve the plastic co-injection process. They have adapted it to the fabrication of automobile parts. This technology was developed around the beginning of the 1970s by the British ICI company. It enables the sequential injection of two different plastics into the same mold. The advantage of this method is that it greatly facilitates the realization of a sandwich-type structure, rendering it possible to produce a part, in a single operation, with characteristics conventionally contributed by different elements—a part, for example, that combines in a single structure a "skin" and a "core," either or both of which may be malleable or rigid.

### A Titanium Steel for Crankshafts

Specialists of the Ascometal company and PSA [Peugeot Corporation] have developed an original material to replace the castings and forged steels used until now for the manufacture of crankshafts. This titanium-doped microalloyed steel, baptized 35 MV7, requires no treatment whatever after forging. According to its originators, who submitted it to numerous tests in the manufacturer's fabrication shops, it is compatible with high productivity, at the same time diminishing costs. Compared with crankshafts made of AISI 41-42 steel, these new pieces cost around 13 percent less: a gain of 10 percent on the raw piece, 15 percent on machining operations, and 15 percent on heat treatment. Peugeot's plants have already produced 2,000 pieces made of this new steel.

### Transmissions: Composites On the Rise

The equipment manufacturers are increasingly participating in the design of products and subassemblies ordered from them by the car manufacturers. This encourages them to innovate. The GKN group is increasingly using composite materials for the manufacture of its products. Using such materials, it has developed a tulip for sliding joints and transmission drive shafts. This choice is explained by the advantages of composites: good mechanical and chemical characteristics (light-weight, anisotropy, internal damping...), and very high performance under operating conditions. The Audi 90 Quattro and the Renault Safrane Quadra are already equipped with transmissions involving tubes made of composites (carbon-fiber-reinforced epoxy resin and glass). Three new applications are planned for powered and 4-wheel drive vehicles in Europe and Japan. The advantages of this solution are far from negligible: simplification of design, improved transmission drive shaft assembly methods, sizable (between 40 percent and 60 percent) weight reduction gains, etc.

### Laser Welding an Imperative

Laser welding continues to gain ground in the manufacture of automobiles. Its most recent success is noteworthy: At its Meudon mechanical construction plant,

Peugeot Citroen Industrie has developed a very original laser welding cell. This installation automatically spot welds two pieces of sheet metal of different thicknesses, over a length of 600 mm. The operation is carried out by means of a 5-kW transverse flux CO<sub>2</sub> source. The six-mirror optical path was designed by Rofin Sinar. This laser is mounted on a five-axis gantry-borne machining center, two of whose axes are rotary. The installation produces 1,100 pieces a day (in several variants) on two shifts per day. It is to be transferred to another of the group's plants.

#### Surface Treatment by Excimer Laser

Researchers of the University of Erlangen, near Nuremberg, in Germany, have developed a surface treatment for automobile components, using an excimer laser. The major advantage of this type of source is the shallow penetration of the metal by its beam. This is owing to the wavelength chosen (from 193 nm to 351 nm), and to the short duration of the source's pulsation (10 to 100 ns). The surface treatment takes place without altering the piece's mechanical qualities in depth. Equipped with a Siemens XP 2020 excimer laser, the installation operates at an average power rate of 40 watts. Externally, it can treat pieces up to 200 mm in diameter, and internally, pieces whose diameter is not less than 50 mm. Tests have been run on crankshafts, motor cylinders, and camshafts. The results of these tests, however, have revealed several difficulties in the use of the excimer laser: cleaning of the optical components, homogenization of the beam and its guidance, high gas costs, still insufficient power... These obstacles must all be surmounted before an installation of this kind can be expected to provide real service.

#### Fault Analysis

It is called AMDEC [Analysis of Fault Modes, Effects, and Criticalness]. It is a particularly effective method of economic and technical analyses for the purpose of comparing competing manufacturing methods. It was used by Renault when the latter had to choose between the systems under consideration for the welding of the Safrane's transmission components. From the very outset of the design of the new car, the manufacturer's team and that of the supplier of the systems, Sciaky Industries, undertook a comparative analysis of the different possible methods of fabrication: arc welding, friction welding, laser welding, or electron beam welding. Each of these methods was put through a thorough comparative AMDEC test, which showed laser welding the winner. Renault's welding experience would have favored the electron beam method. But the AMDEC analysis showed that this technology presented numerous potential problems: pollution of the vacuum chamber, shifting of the magnetic field, laborious preparation of the pieces prior to welding, and substantial maintenance and down times for repairs.

#### Laser Welding for the Hood

The laser can successfully replace spot welding in applications where, until now, it has seemed less efficient. At Opel's Bochum plant in Germany, a robotized laser welding system now assembles the Astra's hood and door components. Four pieces 18 mm long are welded in less than 15 seconds! Other advantages are: better surface quality, improved precision, less constraints to be taken into account in the design stages, and a substantial reduction in costs. The Modulaser uses a Rofin Sinar CO<sub>2</sub> 2kW source, which is capable of welding at a speed of 3 meters/min. But it can also perform a cutting operation by simply changing the laser head. According to Robomatix's experts who designed the installation, the laser produces less deformation of the welded pieces than the other methods, and enhances their resistance to corrosion.

#### Computerized Plasma-Arc Cutting

Reis, a German manufacturer of robotized systems, has developed a fully-automated plasma-arc cutting system. Designed for a manufacturer of utility vehicles, it replaces the 20 manual cutting stations that prepared and cut steel pieces to the size required for welding. An arduous job because of the noise, dust, and heat it generates.

The plasma-arc cutting system consists of a Reis SRV 121 six-axis robot, and two work tables. The robot controller (Robostar III) also controls a seventh axis: a cutting torch that can vary the beveled angle from 0 to 60°. The system's key element is the laser scanner mounted on the robot's arm. Its role is to detect the edges of the piece to be cut, to compensate for the differences that could be generated between the shape of the piece as designed in CAD [computer-aided design] and as actually cut by the robot. This device is controlled by a computer connected to the robot's numerical control by a VME [virtual machine environment] bus. An Ethernet network also interconnects the CAD positions and the installation's programming positions to the plant's central management system.

#### Footnote

\* The proceedings of the ISATA Congress sessions can be obtained from the ISATA Secretariat, 42 Lloyd Park Avenue, Croyden, Surrey, CRO 5SB, Great Britain. Tel (19) 44 81 681 3069. Fax: (19) 44 81 686 1490.

#### EC Project Develops Plastic Automobile Engine

93MI0010 Bonn DIE WELT in German 24 Sep 92 p 9

[Article by Norbert Lossau: "A Quiet Plastic Engine—The Prototype Passed All the Tests, but There Are No Plans for Series Production for the Time Being"]

[Text] Can car engines be built out of fiber-reinforced plastic? Yes—but metals still have to be used at present for moving parts subjected to particular stresses, such as

pistons and cylinders. This is the result of a three-year EC research project that aimed to develop and build a "plastic engine." Under the leadership of the Ford automobile group, seven European companies took part in the project.

The final report confirms the basic suitability of glass-fiber reinforced plastics for the construction of car engines, and in the end the researchers were actually able to present a working prototype of a plastic engine, which proved superior in some important respects to a metal engine of the same design.

Firstly, the weight saving achieved by using plastic obviously means a corresponding reduction in gas consumption. Moreover, the plastic engine's better thermal insulation means that it can be warmed up much more rapidly (up to 15 percent faster), and this also saves gas. The researchers believe that further improvements could reduce engine warm-up time by as much as 50 percent.

The plastic engine also performs much better than its metal counterpart in terms of sound insulation. Engine noise escapes through the plastic at a greatly reduced level. A car with a plastic engine would thus move through the streets much more quietly. Finally, such an engine generates far less vibration.

The plastic engine passed a 204-hour continuous operation test without difficulty. For the last 80 hours of the test, the engine ran at full load and at 5,000 to 5,500 rpm—without any failure.

Anyone hoping to buy a car with a plastic engine in the near future is going to be disappointed. Ford is not yet thinking of developing the glass-fiber reinforced plastic engine to series production level, as such an engine would probably not be competitive with conventional engines in the foreseeable future.

Apart from the question of the production costs and economic viability of a car with a plastic engine, there is an important environmental aspect to be taken into account: Unlike homogeneous plastic waste, fiber-reinforced plastics cannot be recycled. No methods have yet been devised to separate the different constituents of the fiber-reinforced plastic at an acceptable cost and then reprocess them for particular uses.

Research and development work on new materials and plastics for engine building is continuing, however, and it seems to be only a matter of time before a plastic is found that is inexpensive to produce and easy to dispose of, and from which light, fuel-saving car engines can be produced.

## Electric Vehicle Field Test on German Island Underway

93MI0028 Bonn DIE WELT in German 5 Oct 92 p 12

[Article by Norbert Lossau: "High Tech Put to the Routine Operation Test: Unique Field Trials With Electric Cars on Ruegen Island—Government Puts 22 Million Into Project"]

[Text] In Binz, on the island of Ruegen, last Friday Federal Research Minister Heinz Riesenhuber fired the starting pistol for a four-year field trial. A total of 60 electric vehicles will be put to the practical test on this, the largest German island. The suitability of the electrically-powered vehicles for everyday use, their power consumption, safety in traffic, and service life, will be determined under real conditions. The users will include local authorities, charitable institutions, bus companies, and the German postal service. The project will cost around 40 million German marks [DM], including a DM22 million Federal Research Ministry grant.

The electric vehicles comprise 37 passenger and 23 vans and buses supplied by BMW, Mercedes-Benz, Opel, and Volkswagen, which are scheduled for gradual entry into service on Ruegen from now on. They are all series-production models that have been fitted with electric engines and batteries. One of the main purposes of the field trial is to investigate the efficiency of various types of battery and accumulator. Nickel cadmium batteries will be used in 23 vehicles, sodium sulfur batteries in 22, sodium nickel chloride cells in 13, and lead gel batteries in two.

All first-generation electric vehicles were equipped with lead accumulators, but they are not ideal for operating electric cars as they are much too heavy. Only with the development of high-powered batteries, like those now in use in the vehicles on Ruegen, does running electric cars become an economic proposition. Given the same storage capacity, a sodium sulfur battery, for example, is around four times lighter than an equivalent lead accumulator. Even now, cars equipped with a modern, high-performance battery, can achieve an autonomy of more than 200 km before needing mains recharging. They consume approximately 15 to 20 kW-hours per 100 km covered, equivalent to the amount of energy contained in two liters of gasoline. The vehicles taking part in the field trial on Ruegen can be recharged at public "electricity filling stations." One of the charging stations will obtain part of its electricity from solar cells, which convert sunlight directly into electrical energy.

This large-scale trial will be accompanied by an Energy and Environmental Research Institute study that will compare electric cars with vehicles running on gasoline and diesel from an ecological point of view. As well as day-to-day running, it will also cover the energy provision, vehicle manufacturing, and disposal aspects.

**France: PSA To Market Two Electric Cars***93WS0040D Paris AFP SCIENCES in French 1 Oct 92 pp 41, 42*

[Article entitled: "Electric Cars: France Takes the Lead"]

[Text] Florence—The 11th international symposium on electric cars was held in Florence from 27-30 September, and highlighted France's lead over the chief industrialized countries. France's front position is reflected in its research vehicles and its political will to quickly accustom people to using electric cars.

Since Matra-Renault's electric prototype Zoom, which was presented in Paris in early September, stayed home, top billing among the 40 vehicles exhibited went to Citroen's Citela prototype and Peugeot's small 106 electric car. The 106 electric attracted special interest after PSA Peugeot Citroen confirmed on 28 September that it planned to market it in 1995, together with a Citroen AX electric car. The two cars will not cost any more than equivalent thermal-engine vehicles, and are expected to attract customers of passenger cars.

The PSA cars will have four real seats, autonomy of 60 to 160 km (depending on how they are used), and acceleration of 0 to 50 km an hour in nine seconds. That means they will be able to function in city traffic. Equipped with batteries that can be recharged in eight hours using any 16-ampere electrical outlet, the vehicles will be able to travel 40 km after a "quick" recharge of 20 minutes in a service station.

Given the high cost of nickel-cadmium batteries, Jean-Yves Helmer says PSA Peugeot Citroen has opted to rent them through a still-uncreated company that will be responsible for their maintenance and recycling. Rental fees will be fairly high, but the longevity (about 300,000 km) and low recharge cost (about 8 French francs [Fr] per 100 kilometers) will enable drivers to break even.

PSA Peugeot Citroen hopes to sell around 3,000 electric cars a year in 1995, 10,000 in 1997, and 50,000 just after the year 2000. No other manufacturer that took part in the Florence symposium has so far done as much to promote electric cars. PSA Peugeot Citroen invests \$40 billion a year in the effort.

Moreover, French manufacturers are the only ones to have extracted active political support from their government. On 28 July, a skeleton agreement on building the infrastructure for recharge and maintenance services was signed between the French Ministries of Industry and the Environment, Electricity of France, PSA Peugeot Citroen, and Renault. The agreement stipulates that 10 pilot cities will be equipped with battery-recharge terminals between now and 1995. Thirty-five cities have already applied, and the final selection will be made 23 October.

Three cities in western and central-western France have already signed agreements with Renault and PSA Peugeot Citroen. Paris, Marseille, Lyon, and Strasbourg will

certainly be equipped. Symposium participants say France's lead should stimulate the industry in Europe. In Scandinavia, where there is a good electric-socket infrastructure, a deliberate policy to promote electric cars could be implemented quickly. In Germany, Leipzig is in the midst of preliminary talks with PSA Peugeot Citroen.

Outside Europe, the Japanese government would like to see 200,000 small commercial electric cars in the archipelago around the year 2000. California has decided that two percent of the state's registered vehicles must be "100-percent non-polluting" by 1998. That percentage will be raised to five in 2000 and 10 in 2003, in a market that is estimated at about 200,000 vehicles a year.

**France: CARMAT, MOSAIC Study Composite Materials***93WS0041A Paris L'USINE NOUVELLE in French 1 Oct 92 pp 38, 39*

[Article by Pierre Grumberg: "New Materials: To Each His Own Eureka"; first paragraph is L'USINE NOUVELLE introduction]

[Text] PSA (Peugeot) and Renault want to incorporate more and more new materials into their cars, to significantly reduce weight and structural parts.

Whether CARMAT or MOSAIC, the two European programs headed by Renault and PSA have a single goal: to improve manufacturing flexibility and significantly reduce the weight of cars. CARMAT ("mat" for materials) was awarded the EUREKA label in 1986 and is drawing to an end; MOSAIC [Optimized Materials for Innovative Automobile Design] is only halfway over and is slated for completion in late 1993. The manufacturers, however, have already learned a few first lessons.

"Our initial goal was actually to study three things: car structure, safety, and noise comfort," explains Patrice Larguier, PSA's CARMAT person. "Then, the new objectives of lightening cars and finding more and more ways to protect the environment were added while the program was in course."

Adds Henri Mathiolon, MOSAIC coordinator at Renault, "Our main goal is to lighten cars without adding to their cost, which theoretically reduces fuel consumption in the city, and also to optimize production costs."

The two manufacturers quickly realized that there were two, not one, main solutions for achieving these goals. The first was to use steel to lighten cars. To those who object that steel is not, strictly speaking, a new material, Germain Sanz, director of Sollac's research, development, and metallurgy division, shoots back, "Over half of the steel-based materials now used in cars did not exist five years ago! We reduced weight by 20 percent on the part (the substructure) that we studied in the MOSAIC program. That is just barely less than the accumulated gains from using aluminum and composites..."

Sollac's solution uses so-called HEL [high elastic limit] sheets of metal, which are thinner and thus lighter than traditional sheets while offering the same fatigue strength. Sollac also proposes using "sandwich" sheets in certain areas. Sandwiches are manufactured by injecting a several-micron-thick polymer film between two very thin sheets, from three-tenths to four-tenths of a millimeter thick. "The sandwich absorbs vibrations very effectively: The sheet has a cardboard-like ring to it," explains Germain Sanz. "The result is a vehicle that weighs 10 to 20 kilos less." The last trick used by engineers employing "steel" is to put together a structural collage using Ciba-Geigy's Araldite-type adhesives. This eliminates 30 percent of the welding spots as well as some mountings.

The "new steel's" rival is the aluminum/composites duo. In MOSAIC, researchers build the "birdcage" of a metal known for its lightness, extruded aluminum, and combine it with a front end and floor of composites (polymers and HMC, SRIM or TPC glass fibers, which are much cheaper than carbon fibers). "Through MOSAIC we were able to prove that a composite front end absorbed as much energy as a steel one," say staff at the Dutch chemical maker DSM. Reduced weight is an obvious advantage of using composites, but so are fewer parts, the number of which is sometimes reduced by a factor of 10! Of the two, which will prevail, steel or composites? In fact, they are not really competing: The simple steel solution is available immediately and does not require many assembly line changes, whereas it will take over five years to validate composite designs on an industrial scale.

Renault and PSA have high expectations for spinoffs from their programs. But their ultimate aims are a bit different. Renault plans to build complete prototypes, while PSA is content to test hybrid designs on already-existing models, by grafting, for instance, a composite floor onto a Citroen AX body. In contrast to MOSAIC, which focuses on "structure," CARMAT also plans research on glass (glass and plastic hybrids) and "skins" (composites or composite-steel hybrids).

Unlike steel, however, plastics create real recycling problems. "We can reuse plastic to produce energy and asphalt. Or we can salvage it to make composites for applications with lower performance requirements," says Professor Galli, president of Montecatini Technology (Italy) and the designer of MOSAIC's reinforced-polymer floorboard. Yes, but at what price?

#### **Table Information: CARMAT and MOSAIC, European Partners**

The CARMAT program was authorized in June of 1986. Its coordinator and chief contractor is PSA (France). Companies working on plastics and composites within the program include DSM (Holland), ICI (Great Britain), and BASF and Bayer (Germany). Saint-Gobain Vitrages (France), Vegla (Germany), and Cristaleria Espanola (Spain) are collaborating on window research,

and the metal material and "sandwich" researchers include Usinor-Sollac and Fonderies Montupet in France, and Hoogovens in Holland.

Authorization for the MOSAIC program was given in November of 1990. The coordinator/chief contractor is Renault (France); the company researching the steel is Usinor-Sollac (France); and DSM (Holland) is conducting the composites studies. Hydro Aluminium (Germany) is working on the aluminum component, ECP (Enichem Polimeri, Italy) on the floorboard resins, and Montecatini (the Ferruzzi-Montedison group, Italy) on the polymer floor.

The programs have generated several designs, with corresponding weight reductions. One solution is an aluminum structure with a front end of composite materials. It trims the structure's total weight by 20 to 25 percent and cuts the number of parts used by an average factor of 4 or 5. Another solution is the use of HEL metal sheets over 18 percent of the body, instead of the current 7 percent. This reduces weight by several percentage points over traditional sheets. A third solution consists of using a "sandwich" sheet over 17 percent of the body, compared to zero now. The sandwich itself does not weigh any less, but the structure's weight drops a few percentage points due to lighter sound and vibration insulation.

#### **EC Prometheus Traffic System Program Nears Conclusion**

*93MI0041 Bonn TECHNOLOGIE-NACHRICHTEN  
MANAGEMENT-INFORMATIONEN in German  
18 Sep 92 pp 20-21*

[Text] Congestion, jams and multiple collisions are everyday features of our roads. The reasons are manifold, as are varied the solutions proposed. For example, if drivers could receive earlier information on traffic hazards and react sooner to it, many accidents could be avoided. The fact remains that over 80 percent of all accidents involving personal injury are caused by drivers. Furthermore, EC estimates put annual economic losses throughout the European Community resulting from misrouting, trucks traveling without loads, poor choice of route, and delays caused by traffic jams at around 40 billion German marks [DM]. In all these cases, rapid, targeted information would be a great help, and the European PROMETHEUS project is pursuing solutions along these lines.

PROMETHEUS stands for the EUREKA [European Research Coordination Agency] Program for a European Traffic System with Highest Efficiency and Unprecedented Safety, and is a research program initiated by the German automobile industry to devise systems and solutions using advanced electronics to make Europe's roads safer and more efficient, environment-friendly, and convenient.

As PROMETHEUS is predominantly a basic research project and entails a high element of development risk,

the BMFT [Federal Ministry of Research and Technology] has provided it with over DM105 million in funding since 1986. The German automobile industry has also provided DM218 million, a further DM410 million being contributed by other European automobile companies. The governments of the countries concerned have also provided around DM185 million. Expenditure on this EUREKA project by industry and governments throughout Europe has thus totaled almost DM1 billion since 1986.

As the conclusion of the second development phase of PROMETHEUS approaches, on 31 December 1992, the time has come to take stock of the R&D results now ready for testing, and how they might find practical application in everyday road use.

The prototype information and communications systems are now ready to progress beyond the precompetitive stage and be implemented in the immediate or foreseeable future. They include both vehicle-autonomous systems, installed in demonstration vehicles for:

- Regulating speed and maintaining a safe distance from other vehicles:
- monitoring and indicating tire-road adhesion, and infrastructure-supported systems for:
  - receiving the new digital traffic radio, RDS/TMC (Radio Data System/Traffic Message Channel);
  - individual vehicle direction and guidance to destination, using Baken (roadside transceivers);
  - dual guidance to destination, i.e., a combination of autonomous guidance to destination using digital roadmaps and traffic-dependent traffic information via RDS/TMC;
  - providing advance route information, i.e., transmitting safety-relevant information that cannot be predicted by the driver (e.g., road conditions, jams), relayed via Baken from one vehicle to another;
  - fleet management, using satellite localization and communications.

Mass introduction of the two vehicle-autonomous systems first named above is primarily in the interest of and a matter for vehicle manufacturers. Where necessary, it must be ascertained whether the legal and statutory framework must be adapted for this purpose, or even created. This will not require investment out of public funds.

For the second group, infrastructure-supported PROMETHEUS journey information and guidance systems, the different systems involved will require varying levels of infrastructural investment. Accurate estimates and cost-benefit analyses are not currently available.

It will be up to the BMV [Federal Ministry of Transport], in conjunction with the laender, to provide technically feasible and economically and ecologically acceptable solutions to traffic problems, within the overall transport

system. By way of preparation for the requisite decisions, the BMV, in consultation with the automobile industry and the laender, is currently devising a strategy for introducing advanced information systems. The technical systems available, their potential for use in an integrated overall traffic system, and associated problems will be set out in a discussion paper. The results of national and European tests and field trials, such as the EC-funded DRIVE [Dedicated Road Infrastructure for Vehicle Safety in Europe] II program, will also be taken into account.

DRIVE II, with 56 projects and approximately ECU120 million in funding, focuses on testing the results of R&D on wholly infrastructure-supported systems obtained in DRIVE I and PROMETHEUS in European field trials. Considerable progress has already been made with the harmonization required to ensure Europe-wide compatibility for these systems.

Europe still has a substantial technological lead over the American Intelligent Vehicle Highway System (IVHS) program and similar Japanese programs. If we are to take advantage of this lead, all those concerned must work together on turning research findings into working systems.

### **French Firm To Market Composite Shafts in Japan**

93WS00940 *Toddington NEW MATERIALS INTERNATIONAL in English Oct 92 p 2*

[Article: "France: GKN To Supply Composite Shaft to Japan"]

[Text] GKN has won three contracts to use its advanced engineering composite material technology for automotive drive shafts in both rear-wheel and four-wheel drive applications to be launched soon in Europe and Japan. The firm also claims to have developed a metal matrix composite (MMC) shaft based on aluminium.

Longitudinal drive shafts for either rear or four-wheel drive vehicles are traditionally fairly robust components made from heavy gauge steel tubing. They are used to drive the rear wheels through the final drive and therefore rotate at a significantly higher speed than the individual half-shafts, which are located after the final drive reduction gearing and rotate at the same speed as the wheels.

To allow the engine and a chassis-mounted differential to move freely on their insulated mounts and a live rear axle to articulate with suspension movement, joints of various types are always installed at either end of a longitudinal drive shaft. When a supplementary support bearing is provided an additional universal joint is also fitted nearby.

GKN Automotive produces transmission shafts for these applications with a wide choice of joint designs including Hooke's joints, ball or tripod constant velocity joints and

flexible coupling. Material technologies for the shaft include steel, aluminium and composites manufactured from carbon or glass fibre reinforced polymers. Recently there has been an increasing interest in the application of scientifically engineered composite drive shafts. Material in properties of a composite shaft can be tailored to the specific requirements of an application, to suppress noise, vibration and harshness (NVH) more effectively, save weight and improve safety.

Some five years ago GKN introduced the first composite drive shaft into production for the four-wheel-drive version of the Renault Espace, known as the Quadra. It used epoxy resin reinforced with a mixture of carbon and glass fibres that were continuously wound in a cylindrical shape to provide rigid torsional stiffness with minimum rotational inertia.

Since then a similar design has been developed by GKN for the new generation Audi 80 quattro and for the four-wheel drive version of the latest Renault Safrane. Composite materials were originally introduced for coupling tubes in longitudinal shaft designs to eliminate the need for an intermediate bearing. The high specific modulus of carbon fibre reduced the amplitude and magnitude of the disturbing forces, giving a much smoother transmission of power to the rear wheels and eliminating the resonant frequencies that often excite annoying boom periods in the vehicle body structure. This allowed the design of the shaft and the assembly procedures to be simplified. It also saved between 40 and 60 percent of the component weight.

The directional properties of composite materials also allow component engineers to improve on the acoustic performance of the drive shaft, reducing the NVH, and to add complementary functions (such as improved longitudinal crash force distribution in a frontal impact). Composites are corrosion resistant, which eliminates the need for protective component treatments in the vulnerable underbody areas. They also have a good resistance to fatigue failure to meet specified endurance limits.

Current development work on composite shaft design at GKN is concentrating on extending the use of advanced materials from the coupling tube to the end connectors and eventually the metal elements of the joints themselves. This would provide further significant reductions in the weight, reduced manufacturing tolerances, improved dynamic balance and less free play.

By substituting moulded end connectors and a composite shaft disc a new generation of transmission components is now feasible that is able to reduce the weight of a conventional longitudinal steel drive shaft by as much as 75 percent. Thus in a typical V6-engined rear-wheel drive car, GKN claims a weight reduction from 10 kg for a conventional two-piece steel propeller shaft to 5 kg for first generation composite shaft with steel end plates, to 2.5 kg for the 'new generation' shafts with plastic end plates.

Among areas where successful development work has been carried out is the field of new materials such as composites and aluminium. Use of aluminium, for example, permits a 30-40 percent saving in weight, and has the added ecological benefit of complete recyclability.

Driveshafts made from Metal Matrix Composite (MMC) material have also proved their considerable commercial potential. By reinforcing aluminium with a ceramic fibre from aluminium oxide, it has been possible to reduce weight, increase strength, and allow manufacture of longer shafts that can replace heavy, two-piece, steel shafts.

## BIOTECHNOLOGY

**France: Success in Human Genome Experiment Has Applications for Hereditary Disease Research**  
*92WS0834C Paris LE MONDE in French 19 Sep 92 p 13*

[Article by Jean-Yves Nau: "A Team of French Researchers Makes a Spectacular Breakthrough in Decrypting Human Identity"; first paragraph is LE MONDE introduction]

[Text] A team of French researchers led by Professor Daniel Cohen, the director of the Center for Human Polymorphism Studies in Paris, are publishing the results of spectacular work to decrypt the human genetic heritage (genome) at the molecular level. It will appear in the next issue of the American review CELL<sup>1</sup>.

The "human genome" program is the product of joint advances in genetics and molecular biology that occurred at the end of the 1980s, and is one of the most thrilling scientific adventures of the 20th century. It is also, as the biologist Jacques Testart stresses (see LE MONDE Sciences-Medicine, 17 Sep), an endeavor that could quickly help spawn a new form of eugenics unless safeguards are set up.

The ultimate goal of the "human genome" program is to decode the structure and function of the entire genetic inheritance of the human species. In other words, it aims to analyze how the DNA sequences that make up chromosomes and molecular bases of heredity fit together. Scientists know that DNA consists of an arrangement of four chemicals (four bases) and that the human genome is made up of a total of three billion of those bases.

In a sense, the project consists of mapping for the first time the raw material that forms the substrate, memory, and specificity of the human species. It also seeks to separate, from the standpoint of molecular genetics, the "normal" and the "pathological," to detect and understand in physiopathological "detail" the approximately 3,000 genetic afflictions the human species is susceptible to.



### Like a "Game of Dominos"

Despite the sums invested and the technical progress made in human genetics, it was not thought that scientists would be able to fully decode the human genome before the end of the century. The publication of the French researchers' results in the American review *CELL* should, Daniel Cohen claims, save several years and a great deal of money.

"The human genome was cut into bits of nearly 1 million bases, which were in turn cloned in beer yeast as artificial chromosomes," explain the French researchers. "The genome was cut in five different ways so that the chromosomes were not sliced in the same places. These five different cuts produced 22,000 fragments, whose position on the chromosomes was not a priori known. We analyzed each of the 22,000 fragments individually so as to get a print for each of them."

"We then compared pairs of the prints taken from the 22,000 fragments using a computer," continues Professor Cohen's team, "to uncover similarities. Indeed, two fragments from two different cuts taken from the same region of one chromosome partially overlap and have an identical base sequence across a part of their length. This gives them fairly similar prints. As in a game of dominos, the fragments that overlap will fit together in a continuum that recreates the original chromosome order. There are still breaks in this chain at several points along the chromosomes, but over 1,000 sections have been recreated in this way. Altogether the sections cover more than half of each chromosome, or 50 percent of the human genome. Moreover, we demonstrate that an analysis of the 24,000 additional fragments will enable researchers to cover over 94 percent of the human genome by the end of this year or the beginning of the next."

The new tool is being made available to research teams the world over. It is expected to save scientists four to five years and to reduce the initially estimated cost of the international program to sequence the human genome by a factor of five to 10. Still, according to Professor Cohen's team, the results of their work will significantly shorten the time scientists thought they would need to discover the genes involved in certain genetic illnesses (from five to 10 to one to three years).

### Detecting Genetic Maladies

One of the top specialists in biology and molecular genetics, Professor Axel Kahn, attributes the results of Professor Cohen's team to the combined use of a remarkable technique and robotics and data-processing capabilities. "The team was able to develop a sort of 'gene factory'—220 people for five researchers—a real model that is now proving its effectiveness," says Axel Kahn. "To use a geographical image, their research makes it possible to map the human genome at 1:200,000 in short order. This will be a highly useful guide to us in localizing and identifying particular genes involved in a malady. Instead of, say, methodically taking spot aerial

photos of France, Professor Cohen's team multiplied the photographs and found a way to fit them together. Henceforth, we know that we are within 100 kilometers of a pathological gene."

Besides questions of methodology—whether to take a chromosomal versus a global approach—such a study raises even more acutely the question of the ethical consequences of such an undertaking. The issue is resurfacing on the eve of a scheduled international meeting<sup>2</sup>. We may well wonder about the possible future uses of the exhaustive decoding of the human genome.

For now, Professor Cohen's team is sticking to the progress scientists will be able to make in comprehending hereditary illnesses, as well as diseases where we know heredity can play a role. "One of the major consequences will be to vigorously promote understanding of the causes of hereditary illnesses," sums up the team enthusiastically. "The latter, which number 3,000, are responsible for 30 percent of child mortality, but also for the majority of adult pathologies: diabetes, asthma, allergies, rheumatisms, Alzheimer's disease, obesity, cardiovascular illnesses, and cancers."

But how far will scientists go in "understanding" the causes of these illnesses? The development of a genetic marking system could very quickly lead to a narrow use, such as during prenatal diagnosis, or on human embryos before they are implanted in the uterus. Its development could also give us a better grasp of the physiopathological mechanisms involved in many illnesses, enable us to devise new therapies, and make it possible to correct the gene flaws of genetically malformed organisms. No one yet knows what use will be made of this fantastic breakthrough in our intimate knowledge of living beings. It will soon provide a method that will probably allow us to treat individuals more effectively, but also to genetically "improve" the species.

### Footnotes

1. "Mapping the Whole Human Genome by Fingerprinting Yeast Artificial Chromosomes," *CELL*, dated 18 September. Under the direction of Daniel Cohen, researchers from the Center for Human Polymorphism Studies (Paris), Genethon (Evry), the National Institute of Data-Processing and Automation Research (Le Chesney, France), and the Genetics, Molecular Biophysics, and Biochemistry Department of the Yale University Medical School (New Haven, Connecticut), worked together on the study.

2. "Human Genome 92," 14-17 October, Nice-Acropolis. This annual conference that has previously been held in San Diego, California, will be organized for the first time in France.



### **Germany: Genetic Engineering Services Lab Opens in Freiburg**

*93MI0001 Graefelfin BIOENGINEERING in German No 4, Aug 92 p 8*

[First paragraph is BIOENGINEERING introduction]

[Text] The new genetic engineering laboratory recently opened in Freiburg by the Technical Monitoring Agency for South-West Germany will be a genetic engineering services center for public authorities and industry. It also accommodates a newly established team of specialists on biological safety.

The Freiburg laboratory is equipped to carry out microbiological, molecular genetic, and biochemical work, and has been initially registered as a genetic engineering facility operating under safety level 1. According to the monitoring agency, however, it is built and equipped to safety level 2 requirements, so an extension could be applied for whenever necessary.

The first task of the new biological safety team is to support the relevant land-level authorities in monitoring genetic engineering work facilities.

The technical apparatus installed at biotechnology facilities can be inspected jointly with the Technical Monitoring Agency's team of plant safety experts. By arrangement with operators and monitoring authorities, this "biology and engineering partnership" will draw up a comprehensive range of safety monitoring services for plants of this kind.

In view of the continuing great need for research on certification and inspection procedures, the biological safety team will also undertake its own development work. This applied research will initially devise certification procedures for genetically modified microorganisms; close cooperation with universities and other institutes will provide access to the latest research results.

The scientists at the South-West monitoring agency are working closely with the relevant committees and teams of the German Chemical Apparatus, Chemical Engineering, and Biotechnology Society (DECHEMA), the Association of Sewage Engineers [ATV], the German and European standards institutes (DIN and CEN), the European Cooperation and Development [OECD].

The team at the monitoring agency can also provide an external biological safety officer (BBS, as defined in Article 16.2 of the Genetic Engineering Safety Regulations) to monitor plant safety on the spot, in accordance with Article 18 of the regulations. Besides advising the operator of a genetic engineering plant, a BBS is also responsible for inspecting organizational and technical safety precautions. The use of genetically optimized microorganisms for the biological degradation of substances that represent an environmental hazard could well become a reality in Germany in the near future. Experiments and subsequent commercial processes of this type will not only be considered critically from the

biological safety aspect: The biological safety team will give priority to establishing the know-how and the experimental equipment needed to monitor the efficacy of biological degradation processes.

### **Germany: Genetic Engineering Law To Be Relaxed Before 1994**

*93MI0063 Bonn DIE WELT in German 10 Oct 92 p 9*

[Text] The federal government, coalition parties, and SPD [Social Democratic Party] are largely agreed on the need for an amendment relaxing the strict 1990 law on genetic engineering law without raising environmental or health risks, Research Minister Heinz Riesenhuber (CDU [Christian Democratic Union]) and the SPD's parliamentary spokesman on research, Josef Vosen, made clear yesterday.

Vosen did, however, accuse the government of dragging its feet on the revision of the law on genetic engineering. Riesenhuber responded by informing the press that the amendment would definitely come into effect before the end of the current parliamentary term in 1994; otherwise, it would risk a three to four year delay.

According to a draft resolution submitted to the Bundestag by the coalition, the compulsory registration procedure and waiting period for genetic engineering experiments will be simplified, and the international exchange of genetically manipulated organisms will be exempt from licensing.

## **COMPUTERS**

### **Siemens-Nixdorf Improves Productivity by Integrating CAD**

*92WS0838D Paris INDUSTRIES ET TECHNIQUES in French 11 Sep 92 p 72*

[Article by Rhida Loukil: "Siemens-Nixdorf Halves Development Cycle"]

[Text] A huge card bringing together all of the functions of a future computerized system is currently in the prototype stage at Siemens-Nixdorf, at Plaisir in the Yvelines. In the 5,000 interconnections it contains, only two errors have materialized during the first test. Alain Lardenois, manager of the company's Plaisir industrial center, considers the design of cards as sophisticated as this "a feat that could not possibly have been achieved without CAD [computer-aided design]."

This card, whose development has given rise to 15 prototypes, is the first to have been fully designed and developed in-house. It marks the culmination of a CAD integration policy that goes back to 1986. "Before then," says Alain Lardenois, "the physical installation of the card's electrical function had been being done under outside contracts. This gave rise to problems of communication, delays, and costs." Mastery of the entire chain of computerized development, from the computerized

acquisition of drawings to modeling, to set-ups, to simulation, to the testing of prototypes, has netted Siemens-Nixdorf a gain of 30 percent to 50 percent in costs and production times.

The German company's French subsidiary has invested 3 million French francs [Fr] in the procurement of CAD capabilities from the American supplier Dazix. It has also acquired a second automatic card-tester from the American company GenRad. The design is linked to the testing by means of a computerized interface developed by Suisse Diagonal System. Based on the simulation file, this interface automatically generates the test program for the GenRad equipment. In all, the investment totals Fr6 million, most of it in software. The CAD hardware includes, in particular, six printed-circuit design stations and four interconnection-path design stations. It is used by some 40 of the 240 persons working at the Plaisir center.

The card, which has served as a "cowboy" [as published] to this equipment, was developed in the record time of seven months. "Using the old method, it would have taken 15 months to develop it," says Alain Lardenois. With experience, he hopes to further shorten development times to between four and five months. This objective is compatible with Siemens-Nixdorf's goal of shortening the complete development cycle of a computerized system to, as nearly as possible, one year.

#### **Italian Research Center Develops Array Processor Experiment**

*93MI0057 Turin MEDIA DUEMILA in Italian Sep 92 pp 98-99*

[Article by Marco Gasperetti: "A Hundred-Billion-Lire APE"]

[Excerpt] [Passage omitted] It is called APE [Array Processor Experiment] 100 and is being constructed in Italy. Once completed (at the end of the year), it will have a potential processing power of 100 gigaflops, one hundred billion operations per second. They say it will outrank computers costing tens of millions of dollars, such as the Cray, currently in use at the Pentagon and Connection Machine.

The APE is currently coming down the finishing straight. It was put into operation a short time ago for quantum calculus and is already at work. The researchers are already satisfied, but this is only the beginning. "When all the 2,048 processors have been installed," explained Prof. Raffaele Tripiccone of the National Institute of Nuclear Physics at Pisa, APE will have a truly extraordinary potential. It will be of enormous help to researchers and its computing speed will be decisive in our work."

Scientists from the nuclear physics institutes of Pisa and Rome took part in the APE 100 project, a sequel to the APE project involving the development of a computer with a computing potential that is 100 times inferior. At

the head of this ambitious project stands a famous name in Italian science, Nicola Cabibbo. His principal assistants, apart from Professor Tripiccone, are Giorgio Parisi and Federico Rapuano. However, APE 100 also has another revolutionary feature—it is the first personal mainframe that is—it can be adapted to the specific needs of the user. This is because the "raster" was designed not only to perform quantum physics calculations and to simulate the dynamics of fluids in porous mediums but to be extremely useful to private industry as well.

In fact, several Italian industries, first and foremost Fiat, have already shown an interest in the APE 100 project. The Rome and Pisa institutes prefer not to discuss this aspect but the acquisition of this powerful computer by the automobile manufacturer would almost seem to be taken for granted. Why? Because its extraordinary computing speed and parallel structure (calculations are not performed in sequence, data is processed by the over 2,000 processors simultaneously), would make it particularly suitable for use in calculating automobile Cx in the wind tunnel. And this could mean savings of several billion lire. In addition the APE 100 consists of independent modules. Boards can be used to increase (or decrease) its potential which in money terms could mean a reduction in costs. For example: a certain company needs a particular computing potential? No problem, here is the APE 100 in its reduced format. Another buyer needs a more powerful APE? Here are the boards to increase its potential.

In order to bring the project out of the universities, a specialized aerospace company, the Laben company of Milan, has participated in the project. Eng. Roberto Sechi at Laben has said: "There are undoubtedly some very interesting economic aspects of the APE 100. This computer costs 10 times less than the Cray and Connection Machine supercomputers and could become a strong competitor on the market." The "big brain" is equipped with super-miniaturized processes—and this is another novelty—that are produced entirely in Italy. Their overall size is just three centimeters by three but their potential is 50 times greater than that of a computer with a 33 MHz Intel microprocessor, one of the fastest in the personal computer field.

What about the future? It lies in miniaturization, but superstitiously perhaps, the researchers at Rome and Pisa will not actually say so. The future of the APE lies between reality and science fiction. The supercomputer could become 100 times faster and fit on a desk. Could this be the dawning of computer-sapiens?

#### **UK Government Orders Cray Academic Supercomputer**

*93WS0057G Edam SUPERCOMPUTER EUROPEAN WATCH in English Jul-Aug 92 p 3*

[Article by John Gordan, Rutherford Appleton Laboratory, UK: "A New Academic Supercomputer for the

UK"; first paragraph is SUPERCOMPUTER EUROPEAN WATCH introduction]

[Text] Academic supercomputing facilities in the UK received a boost in June when the Government announced that a Cray Y-MP81/8 128 would be installed in the Atlas Centre at the Rutherford Appleton Laboratory near Oxford to replace the aging X-MP/416.

The UK Science and Engineering Research Council (SERC) agreed the procurement of a Cray Y-MP81/8 128 to be installed at the Atlas Centre of SERC's Rutherford Appleton Laboratory (RAL). The Cray Y-MP81/8 128 is an 8-processor machine with 128 Mbyte of memory and, in this instance, 100 Gbyte of disk storage; its peak performance is 2.7 Gflop/s.

The Y-MP will replace a five year old Cray X-MP/416 and will have about three times the power of its predecessor. The machine is due for shipment in August and will come into service in the autumn. The Cray will be connected to the Joint Academic Network (JANET) through which access can be provided to higher education institutes.

Brian Davies, the Associate Director of Central Computing at RAL, said, "This new machine will enable the UK Research Councils to proceed with important research projects which had been held up due to lack of supercomputer resources. It has been suggested that this will be the last conventional supercomputer to be provided for UK academics and that the funding available in future years will be spent on a massively parallel architecture machine. It will be interesting to see whether the market can provide such a machine capable of providing a general purpose multi-discipline service within the required time frame of the next couple of years."

Davies explains that it was an open procurement, first "everybody" could bid; but, in the end only a short list of vendors competed for the contract. Testing was done with a benchmark composed of the current workload with some extrapolations to the future. Davies said, "the selection criteria were based on price/performance ratio, functionality etc." There was no price disclosed, but Davies remarks that "the C90 was outside the price brackets." Nevertheless, Cray won against the Japanese models then current (April 1992).

In the immediate future, the new Cray will enable important research work, which was sometimes "a bit squeezed on the X-MP," as Davies put it, to proceed more quickly. The new facility is likely to enable scientists to tackle in the UK some of the large projects which could only be handled on facilities in e.g., the U.S. As should be expected, Davies is "quite happy" at the present outlook, he predicts a pretty much straight forward enhancement of the computing service—"off we go."

## German, GMD, Russian Academy of Sciences Sign Cooperation Agreement

93WS0094Y Roquencourt ERCIM NEWS in English  
Oct 92 p 23

[Article by Michael Agi: "GMD Concludes Cooperation Agreement With the Russian Academy of Sciences"]

[Text] GMD has laid the foundation for a cooperation with the Russian Academy of Sciences. The two partners concluded a framework agreement on a four-year period of cooperation on 8 May 1992.

On the invitation of Prof. Dennis Tsichritzis, Chairman of the Board of GMD, a delegation of the Russian Academy of Sciences under the leadership of Prof. Vladimir A. Melnikov visited GMD from 6-8 May 1992. Prof. Melnikov is Director of the Institute for Problems in Cybernetics and a member of the Council of Experts to the Head of Government of the Russian Federation. The Russian scientists accompanying him were also from the Institute of Cybernetics in Moscow.

The Russian computer scientists—"cyberneticists" in Russian—conducted talks with scientists and teams of researchers from several GMD institutes. The key question surrounding this German-Russian meeting were the possibilities for cooperation between the two research centres. The scientists from both institutes agreed on a catalogue of themes for future cooperation projects as well as on measures to promote cooperation between the Russian Academy of Sciences and GMD. The following themes were considered important for the envisaged cooperation:

- Automatic parallelisation for computers with distributed memories;
- Numeric cores, parallel algorithms;
- Parallel SPICE2;
- Computer algebra;
- Visualisation;
- Expert systems;
- Pattern recognition;
- Further training/technology transfer

Twelve Russian scientists will be invited to GMD, each for four-week periods, during 1992. GMD institutes have also submitted four proposals for projects. These proposals are to be discussed and developed in the coming weeks. They will then be incorporated jointly within the framework of the special programs of the European Community for the promotion of cooperation with Russia in the field of research and technological development, and possibly in conjunction with institutions of the European Research Consortium for Informatics and Mathematics (ERCIM).

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**Italy: CNR, ENEL Develop Algorithm for Thermal Image***93WS0094X Roquencourt ERCIM NEWS in English  
Oct 92 p 22*

[Article by Mauro Bramanti, Sauro Pasini, Emanuele Salerno and Anna Tonazzini: "CNR-ENEL Collaboration for Thermal Image Reconstruction"]

[Text] With the framework of a collaboration between CNR and the Italian National Electricity Board (ENEL), contracts have been signed for research in the field of reconstructive sonic pyrometry. This type of technique allows the reconstruction of the temperature field inside a power station boiler on the basis of acoustic time-of-flight measurements between pairs of acoustic transducers located on the walls of the boiler.

Knowledge of the local values of the boiler temperature is very important in a thermal electricity generating plant as it can be used both to optimise the overall efficiency and to reduce the emissions of certain pollutants, such as the NO<sub>x</sub>s. In this particular application, the reconstruction of a 2D temperature map is an extremely difficult task, in that only a very small data set is usually available. The research activity at IEI-CNR consists in the development of ad hoc reconstruction algorithms and the comparison of their features with those of already used techniques.

Since 1983, IEI-CNR has been collaborating with the Thermal and Nuclear Research Centre (CRTN) of ENEL, Direction of Research (DSR), in the development of special instrumentation for combustion control and diagnosis and information technology. In 1988, a research contract was signed for the assessment of an already proposed reconstruction algorithm for a computer-aided sonic pyrometry technique. This algorithm is based on a 2D Fourier parametrisation of the slowness-of-sound field in the probed domain and a subsequent least-squares estimate. The temperature values can be reconstructed on the basis of the known relation between the slowness of the sound and the temperature in a gaseous medium. The number of data points typically available for this type of application is comparable to the number of unknowns and the image reconstruction problem is thus very difficult to solve. The algorithm examined has been found to be extremely unstable if a sufficiently detailed map is to be reconstructed.

Since 1990, the collaboration has been extended to the study of image reconstruction algorithms which are stable when working with a limited number of data. Standard regularisation procedures, with different regularising functionals, have been applied to reconstruction algorithms based on 2D Fourier series or different parametrisations, such as sampling, bilinear interpolation and polynomial approximation. A special and very stable reconstruction algorithm has been developed and

is based on ID reconstruction and subsequent 2D interpolation. These algorithms have been shown to give stable solutions even with particularly reduced and noisy data sets.

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**DEFENSE R&D****Europatrol To Create Maritime Patrol Plane***92WS0830B Paris AFP SCIENCES in French 3 Sep 92  
p 10*

[Unsigned article: "European Consortium to Develop Maritime Patrol Plane"]

[Text] Paris—Six European aircraft manufacturers announced on 1 September that they have created a European industrial consortium called Europatrol for the joint development of the 21st century future maritime patrol plane.

At first, Alenia (Italy), British Aerospace (United Kingdom), Casa (Spain), Dassault Aviation (France), Deutsche Aerospace (Germany), and Fokker (the Netherlands) will contact their national governments to establish a project that will become part of the Independent European Programs Group (GEIP).

The communique from the six companies indicates that this first stage will make it possible to define a plane and a joint task system, and to synchronize the schedules of the various European users. In the field of maritime patrol planes, Dassault, Deutsche Aerospace, Alenia, and Fokker have collaborated on the Atlantic planes, British Aerospace has built Nimrod, Casa has produced the C 212 and CN 235 planes, and Fokker the Maritime Enforcer MK2.

**France: Rafale Landing Gear Described***93WS0028D Paris LE BULLETIN DU GIFAS  
in English 17 Sep 92 pp 1-4*

[Excerpt]

**Landing Gear for Rafale**

Messier-Bugatti, supplier of landing gear for a large number of military aircraft, was chosen by Dassault Aviation to design, develop and manufacture the landing gear for its latest aircraft, the Rafale multirole fighter.

The major design constraint imposed by the aircraft manufacturer was the need to store the landing gear in the same structural space on the air force and naval versions of this combat aircraft, although the two landing gear systems are totally different in terms of their operation and dimensions.

To meet this challenge, Messier-Bugatti has designed two systems which are in many ways the culmination of the expertise built up by the firm in materials, kinematics, hydraulics and other key areas of landing gear design.

#### **Messier-Bugatti's role**

Based on the Rafale A demonstrator, two aircraft have now been defined:

- ACT [Avion de Combat Tactique], the air force tactical combat version, with plans to develop the CO1 single-seat version and the BO1 two-seat version;
- ACM [Avion de Combat Marin], the naval version, designated MO1.

Messier-Bugatti was involved in this program right from the predevelopment stage in 1982, continuing through the development of Rafale A in 1984.

Design work on the air force and naval versions started in 1987, culminating in the first flight of the CO1 in May 1991 and the first flight of the MO1 in December 1991.

#### **Specific Characteristics of the Naval Rafale Landing Gear**

Most of the innovative landing gear design features are incorporated in the naval version of Rafale. In fact, it will be the first French aircraft catapulted by its nose gear.

Due to higher stress, the nose gear on the naval version is both larger and heavier than its land-based counterpart. In order to enable it to fit in the well, the upper part of the landing gear is equipped with an aluminium alloy panel that automatically folds during retraction.

#### **General Description**

The nose gear is lowered by an internally-locking strut actuator; it is cross-braced by a drag link that transfers the catapult effect to the airframe. A hydroelectric system gives the nose wheel 360° swivelling capability.

This gear is designed to resist deck-landing descent rates of up to 6.5 meters/second (21 ft/s), compared to 3 meters/second (10 ft/s) for the land-based version, and catapulting loads of about 90 metric tons (198,000 lb).

An uplock holds the landing gear in the retracted position.

The catapult bar is attached to the nose landing gear. A twin-type, wheel arrangement was chosen to allow room for the catapult head.

#### **How It Works**

The naval version Rafale landing gear features two major innovations:

—at the end of the catapulting sequence, the shock strut restitutes the energy stored as it was compressed while pulled by the catapult;

—following takeoff, the shock strut instantly reverts to landing configuration to enable deck landing under optimum shock absorption conditions.

#### **Phase one:**

The catapult bar is hooked to the catapult head, and engines set to full throttle: at this point the aircraft is still held by the holdback link.

As the catapult accelerates the aircraft, the shock strut is strongly compressed and the holdback link automatically severs.

#### **Phase two:**

At the end of the catapult travel, the catapult bar separates from the catapult head. The shock strut, no longer compressed, restores its accumulated energy, vertically accelerating the aircraft and facilitating takeoff. A ski jump is no longer necessary.

An internal controllable device eliminates damping to improve the restituted energy yield.

#### **Phase three:**

For deck landing, the shock strut must be reconfigured by reactivating the metering holes. This helps obtain optimum shock absorption to limit loads and therefore acceleration on impact.

Numerous digital simulations were performed on this landing gear in close collaboration with Dassault Aviation, to optimize both aircraft performance during takeoff and other parameters, including load levels, suspension comfort levels, etc.

A modified Mirage 2000 was tested at the CEAT aeronautical test center in Toulouse to check the theoretical results. Qualification tests on actual landing gear are now under way, and the initial results are very promising.

#### **Innovative Features**

The landing gear design process has led to several other innovative features.

Over the course of this program, Messier-Bugatti has applied for no fewer than 10 patents.

—High-resistance materials and processes to avoid corrosion in a marine environment.

—Higher maneuverability on the aircraft carrier, thanks to the omnidirectional steering system.

#### **A New Omnidirectional Steering Design for the Naval Rafale**

Deploying Rafale on an aircraft carrier demands a very high degree of maneuverability, which requires a nose

wheel with turning capability of nearly 360° under tow and +/-70° when steered by the pilot. The steering system must also provide anti-shimmy protection during deck takeoffs and landings.

Providing these two functions within the reduced space of the wheel well was a real challenge. Messier-Bugatti was able to meet this challenge by developing a new omnidirectional steering control system. This system comprises a hydraulic motor consisting of two double-acting actuators, with a sealed control valve plate. These actuators drive a gear-crankshaft assembly, with the gear turning the rotating tube of the nose landing gear to set wheel direction. Exact wheel control is achieved through a hydroelectric servocontrol system, which compares the pilot's order to the actual position of the wheel as measured by a sensor. If a discrepancy is indicated, the servocontrol system corrects the position of the wheel.

The hydraulic actuator assembly, control valve plate and wheel sensor are integrated in a single unit mounted on the nose gear. The servocontrol system comprises a digital computer which also provides braking control.

#### Advantages

This type of system offers a number of advantages:

- integrated construction,
- compact design,
- ability to function at high pressures without leakage (5,075 psia, with a peak of 8,700 psia),
- omnidirectional steering.

#### Messier-Bugatti Will Supply a Large Variety of Equipment for These Aircraft

- Wheels and carbon brakes.
- Nose wheel braking control and steering system.
- Hydraulic equipment, including actuators, uplocks, etc.
- A high-pressure (3,190 psia) self-regulating pump, using the aircraft's fuel, for control of the M88 engine's nozzle.
- The main pump for the aircraft's hydraulic system (5,075 psia), designed in cooperation with Hydromatik of Germany.

#### Main Pump Specifications

Displacement	39 cc/t
Speed	4,450 rpm
Flow rate	0 to 170 liters/min.
Rated pressure	350 bar (about 5,075 psia)

This is a self-regulating pump with axial pistons, loose cylinder block and cradle-mounted fitting plate.

#### UK Defense Research Sites To Be Consolidated

93WS0081A London *THE GUARDIAN* in English  
30 Sep 92 p 9

[Article: "2,000 Jobs at Risk in MoD Research Cuts"]

[Text] Two thousand civil service jobs are threatened by drastic consolidation of the Defence Ministry's scattered research establishments, now managed by the semi-autonomous Defence Research Agency.

Seventeen sites are to close, including the quality assurance laboratories at the Woolwich Arsenal in south-east London and the experimental flying centre at Bedford airfield. But the DRA is promising "significant investment" in a dozen other sites, particularly Farnborough, Portsmouth West near Portsmouth, the Winfrith in Dorset.

The agency was set up last year to scale down and reorganise the military's extensive research activities so as to manage them like a single business. According to an internal DRA document, its objective is to cut running costs by £90 million a year. That will mean closing smaller sites and concentrating in larger, more efficient establishments like the new Structural Material Centre at Farnborough. Even at Farnborough, however, there will be a net loss of 300 jobs once supporting services have been reorganised.

The proposals outlined in a consultative document sent yesterday to trade unions and local authorities will reduce the DRA's workforce of 11,700 by about 1,950. Malcolm Rifkind, the Defence Secretary, will have the final say after meetings next month with the trade unions. But union leaders complained yesterday that the decisions had already been taken.

Derrick Baker, of the GMB general union, who works on one of the sites scheduled for closure, at Portland, said: "Staff at these establishments were working 24 hours a day during the Falklands and Gulf conflicts. This is no way to treat them. Some of them were presented with medals by Tom King after the Gulf War and now they are told they are not required."

The sites from which the DRA intends to withdraw completely are: Alverstoke (which houses a submarine escape system), Bedford airfield, Christchurch (bridging equipment), Cobham, Dunfermline (warship structures), the Empress State Building at Earl's Court, Funtington, Holton Heath, Horsea Island, Portland North and Southwell (underwater weapons), Portsmouth Main (naval weapons), Royal Arsenal Woolwich East and West, Slough (marine navigation), Swynnerton and Teddington.

Many of the job losses are concentrated in the south of England, around Portsmouth (400), the Farnborough area (320, including Chertsey) and Dorset (350). Several sites in this part of the country will benefit, however, from new investment or will absorb staff from other establishments. Structural materials research, for

example, will be concentrated at Farnborough airfield. Most of the staff from Portland North and Southwell will be invited to transfer to Bingleaves or Winfrith. Winfrith is a new site the DRA hopes to lease from AEA Technology. Haslar, near Portsmouth, will take staff from Portsmouth Main, West Drayton, Holdon Heath and Alverstok. Portsmouth West will absorb staff from Funtington in West Sussex and the main Portsmouth site.

Other sites to be developed are Pyestock (fuel and lubricants), Fort Halstead (armaments), Malvern (radar), Chertsey (vehicles), West Drayton, Aquila (quality assurance), and Rosyth South Arm (warships).

#### Scattered Network Was in Need of An Overhaul

##### David Fairhall On the End of a Jealously Guarded Empire

Many of the research establishments of Defence Research Agency is determined to slim down date back to the days when the three armed services ran separate empires, jealousy guarding their independence and keeping Whitehall at arms length.

The establishments grew up haphazardly and the DRA inherited a scattered and duplicated network, from Rona in the north of Scotland to Portland on the south coast of England.

Forty of the 54 sites are permanently manned. Many are in a poor state of repair and are inefficiently laid out, generating heavy maintenance bills and staff costs. A drastic programme of rationalisation was bound to emerge given the overall reduction in defence expenditure and the DRA's brief to run research like a commercial business.

The agency will dispense with about half its buildings and 60 percent of its land. John Chisholm, the chief executive, said the aim was to provide a more efficient service, which would also be subject to "market-testing."

He said, "The DRA was established as an executive agency in April 1991 and we are aiming for it to become a trading fund next year."

Market-testing is Ministry of Defence jargon for checking to see whether a function could better be contracted out to private management. The DRA will continue to be government-funded, and its reduced staff will still be civil servants.

The reward for cutting costs by a projected £90 million a year is supposed to be substantial government investment in the streamlined organisation.

Apart from the need for increased efficiency, military research was bound to be scaled down to match cuts in the armed forces resulting from the Government's Options for Change review. There was already a widespread view that too many scarce scientific resources were locked up in military research.

Frank Dobson, Labour's employment spokesman, said the party and unions had been urging the Government for years to diversify defence spending into civilian work. "Now the chickens are coming home to roost."

## ENERGY, ENVIRONMENT

### Germany: Halogenated Hydrocarbons Being Phased Out, Alternatives Discussed

92WS0818A Duesseldorf VDI NACHRICHTEN  
in German 28 Aug 92 p 22

[Article by C. Friedl: "Halons Under Fire; Fourth in a Series: Chlorofluorocarbons; Disposal of Fire Extinguishing Agents Is Still Unsettled; Substitutes for Ozone Killer Do Not Extinguish As Well"]

[Text] Duesseldorf, 28 Aug 92 (VDI-N)—Halons have been provided to numerous computer centers, laboratories and manufacturing shops for decades for fire protection. Now the extinguishing agents themselves have come under political fire because of their high potential for destroying ozone. However, neither the question of substitutes nor the disposal of old equipment has been settled.

With the triumphant advance of the computer, halons became the jack-of-all-trades among extinguishing agents. Gone was the complicated handling of carbon dioxide snow; no more thoughts about antiquated extinguishing blankets; forget the foam and powder extinguishers. "Halons have only made it possible for computers to spread," points out Hans-Joachim Jentzsch, computer center planner with the German Health Insurance (DKV) in Koeln. Halons extinguish quickly and reliably. They are effective in low concentrations. And not least, they are not toxic to humans and are easy on the installations and devices.

In the old German states, the discussion on halons centers on basically two substances: bromochlorodifluoromethane (halon 1211) and bromotrifluoromethane (halon 1301). Chemically similar to the much discussed chlorofluorocarbons (FCKW), both are so persistent that they rise up to 20 km in altitude without decomposition and reduce the protective ozone layer there—and in the process, three and 10 times faster, respectively, than the R 11 chlorofluorocarbons. Moreover, the halons are intense greenhouse gases.

According to estimates by the Federal Environmental Agency (UBA) in Berlin, about 600 t of the halons were released annually into the atmosphere before 1989. "The majority was released for a long time during exercises in extinguishing," remembers Holger Brackemann, a chemist with the Federal Environmental Agency. Only since the insurers demanded an end to the tests could the annual load be reduced to 150 t.

Since the beginning of the year, the manufacture, traffic and use of the halons as fire extinguishing agents have

been prohibited by the statute of May 1991, banning chlorofluorocarbon halons. New installations can no longer have halon put in them. Portable fire extinguishers and old installations must be replaced by systems free of halon by the end of 1993.

With this worldwide unparalleled drive, the Federal Environmental Minister, Klaus Toepfer, has stirred up a protest. Countless enterprises in Germany see their security threatened. "We are being ruined," states Volker Lamprecht, manager of the factory fire department at the BASF chemical firm in Ludwigshafen. The main criticism by those affected: While the time allowed for the ban of chlorofluorocarbons was determined by how fast the trade can convert to a substitute agent, the halon part of the statute is, for Rudolf Buessem, "an absurdity which was knitted with a red-hot needle." The technical director at Total Walther in Koeln, whose firm is the market leader for fire protection equipment, cites several reasons for this.

For one thing, a comparably effective substitute has still not been found. Water and powder are often unfit since they destroy the sensitive EDV [electronic data processing equipment] and some show low extinguishing effectiveness. Carbon dioxide snow ( $\text{CO}_2$ ) is suitable as an extinguishing agent only for space protection systems because it is lethal in concentrations over 8 percent. In addition, as an extinguishing agent, it is significantly less effective than the halons. Therefore, six times as much agent has to be stored. For many enterprises, this makes the conversion problematic.

In the fall, Total Walther wants to put an extinguishing agent called Inergen on the market for automatic extinguishing systems. According to the manufacturer, it is nontoxic and economical to manufacture. This alternative to halon 1301 consists of nitrogen (52 vol.), the inert gas argon (40 vol.), and  $\text{CO}_2$  (8 vol.). But even this gas mixture could not reach water in tests relative to the extinguishing effectiveness of the halons.

A compromise between ozone killers and the old extinguishing agents is offered by halogenated chemicals that have hydrogen atoms in the molecule and therefore are more easily decomposed after their release. According to Heinz Hermes, technical director of the Deugra firm in Ratingen, two chemicals containing fluorine, FE 13 (trifluoromethane) and PFC 614, are promising.

Fire protection of a completely different type has been proposed by Christoph Kainz of the Wagner Alarm and Security Systems firm in Munich. "One could often do without an extinguishing agent by early detection of a fire." In practice, however, fire alarms were often installed so that a direct and early recognition of the gases from combustion was not possible. Kainz recommends, therefore, detectors that sit directly on the device

or machine. They detect a fire in the earliest possible stage in which the so-called active alarm supervises the main cooling streams.

In addition to the difficult search for substitutes, the disposal of the now banned halons is also still unsettled. It is true, according to statements from the Federal Environmental Agency, that the usual special waste incineration facilities are suitable in principle, but only small amounts of the extinguishing agent could endure in the input process. It is true that the elegant way—use them up chemically—is technically as good as dissolution (see also VDI-NACHRICHTEN 34/92), but this has nevertheless met a rather restrained response. Siegmund Hug, expert on halons at Hoechst AG in Frankfurt, draws attention to the fact that, "We did not know where to put the recovered bromine."

The only halon disposal facility in operation today is at the Concentric Machines (CM) equipment builder in Treuchtlingen in Bavaria; it uses a multistage method developed especially for chemicals containing bromine and chlorine. In the process, halons are cracked with a combustion gas under pressure at about 2000°C. Inorganic acids and carbon monoxide are the residue.

At present, 5 kg of halons per hour can be decomposed into their components in the Concentric Machines device. According to Michael Zettner, business manager at Concentric Machines, a large system which would solve the German halon problem could be set up "within a few months." However, no disposal enterprise has yet ordered the device from Concentric Machines.

The Federation for Fire Extinguishing Equipment and Systems (BVFA) in Hagen is also counting on the Concentric Machines method. But first, a collection and storage system for old equipment and systems must be set up in Germany. That is easier said than done: The majority of the 1.6 million portable fire extinguishers in private dwellings, businesses and vehicles, in which, according to the Federal Environmental Agency, about 6,000 t of halon 1211 lie dormant, are not registered. Therefore, recall systems are beyond any control. Also, the fate of about 3,000 stationary extinguishing systems with 2,000 t of halon 1301 lies solely in the hands of the respective owners. Herbert Schaefer of the Federation for Fire Extinguishing Equipment and Systems wants to make it clear that "in any case, it is not possible for us to ensure the recall and disposal of halons by the end of 1993."

The reason: Those who transfer, transport, store or dispose of halons are trafficking in special waste and therefore require a license from state agencies. "That can take time," says Zettner, the equipment builder. The start of operations of a large reactor for halon disposal should not be counted on before the summer of 1994. According to Buessem, "Even the recall of old devices can only get started when licenses for intermediate storage are granted."



The halon problem has become more problematic in the neighboring countries. In Austria, existing systems must not be dismantled until a disposal concept is approved. Switzerland even permits halons until 1997 which allows for the development and testing of alternatives.

Meanwhile, in Germany, the halon ban is producing some strange phenomena. "The suppliers refuse to wait for our fire extinguishers," complains Lambrecht a fire protection expert at BASF. The reason: halon will be inadvertently released during the waiting period, the extinguisher can no longer be refilled, and fire protection would no longer be assured.

At the Federal Environmental Ministry (BMU), hardly anyone speaks of halons anymore. "It was not that the ban statute came too early," responds Rolf Engelhardt of the BMU to the complaints from industry, "but that those affected have been asleep too long."

Published previously in this series: FCKW [Chlorofluorocarbon] Substitute Agents Are First Choice Which Substitute Is the Market Offering? FCKW [Chlorofluorocarbon] Recycling Gets Underway

#### Photo Caption

1. p. 22: Good extinguishing effectiveness and simple handling suffice no longer: The ban on halon is forcing the trade to seek alternatives that are not harmful to ozone (our photo shows the refilling of extinguishers containing powder). Photo by amw. [photo not reproduced]

#### German Company Supplies Eastern European Market With CFC-Free Refrigeration Agents

92WS0818B Duesseldorf VDI NACHRICHTEN  
in German 28 Aug 92 p 18

[Article by Peter Weigert: "Kuehlautomat Berlin on the Way in the Western Market; Interest by Industry in CFC-Free Refrigeration Plants Is Growing; Two New Flexible Processing Centers Increase the Manufacturing Capacity of the Trust Enterprise"]

[Text] Berlin, 28 Aug 92 (VDI-N)—The management and factory committee at KAB Kuehlautomat Berlin GmbH are displaying healthy self-confidence. They have already delivered 1,000 industrial refrigeration plants without CFC [chlorofluorocarbons], the refrigeration agent that is harmful to the environment. In DDR [German Democratic Republic] times, the firm had practically a monopoly on the eastern market with the manufacture of efficient and very durable helical compressors. Now, sales success is growing also in Western Europe.

First developed for use on ships, refrigeration plants made by the Berlin firm are now also being used on land, for example in slaughterhouses and cold-storage depots or in industry.

"The world market for helical compressors with a rating of 35 kW to 650 kW—just some while ago, it was 4,000 to 5,000 units—will grow in the short term to 6,000 to 8,000 units," predicts Joachim Renker, Dipl.-Ing. and business manager of the enterprise in Berlin. "There are already bottlenecks in the U.S." A major reason for the increase in demand in the western market is the conversion to equipment that is CFC-free or at least less harmful to the ozone.

Renker wants to increase his firm's share of the world market to 15 or 20 percent, having reached 10 to 12 percent already over several years. Of that, 50 percent is to be sold in the East. The purchase of two automated manufacturing centers from the Fritz Werner Machine Plant in Berlin for processing of compressor housings is increasing the capacity of the firm. The sales organization is being built systematically for Western Europe.

A contact at a specialized exhibition in Essen has led recently also to delivery of the first three helical compressors to Australia. Such an order is a windfall for the industrially experienced business manager: "Other firms have had reference plants in operation for 20 years." The Berlin firm, however, was hardly known in the West in view of clearly eastern oriented exports.

"We now have 10 plants in operation in Germany; another 50 have been sold," Renker added. "We are over the first hurdle; now there is only a certain aversion to us being a trust firm."

By that he means that the question of an impending change in ownership of the business does not always make things easy. The chairman of the factory committee, Hans-Joachim Matzner, is at the same time deputy chairman of the board of directors of the firm, and often mentions the concerns of his colleagues. "We would most prefer to remain independent; after all, as a firm we are stable."

The news about a large Berlin firm being interested in buying has upset the employees: "It is worse for them than for us," Matzner said. Renker and the firm's management are not taking a position and remain neutral. The management and factory committee are convinced that a workable solution for the firm for the future can be reached in the next few months.

Both the board of trustees and the trust agency have released all investments of the firm, and there should be no delays, Renker emphasizes. "Kuehlautomat sees itself, by the way, being treated in a friendly way by the trust agency in all technical areas and on all levels. The cooperation can be described as practically free of problems."

Kuehlautomat became financially consolidated as a firm from its own strength; of the old liabilities of DM45 million, half was already paid back last year. On sales of DM158 million, the profit for 1991 was about DM1.1 million.

Renker, business manager, mentions such amounts not only out of understandable pride in the success. "The firm makes these numbers public mainly to explain to its present and potential customers information on the long-term security of the existence of Kuehlautomat." The same thought prompted him a few weeks ago to make the statement that the firm would be secure even without the Hermes guarantee for its business with the GUS [Commonwealth of Independent States] states.

That is an important statement for the business status of the firm, especially in view of orders from the GUS states worth DM200 million. Since the business partners in the fishing industry there are solvent, deliveries from the Berlin firm are mostly paid in advance. Renker estimates sales of about DM100 million from these businesses in any case for 1992/93.

#### **German, Australian Researchers Develop Neural Network Systems With Security, Industrial Applications**

*92WS0818C Duesseldorf VDI NACHRICHTEN  
in German 28 Aug 92 p 12*

[Article by Dietrich Georg: "Video Camera for Checking Facial Features; Australian Information Scientists Discover Neural Network; Research Ministry in Canberra Estimates the World Market for Artificial Neural Networks in the Year 2000 to Be 6.5 Billion DM"]

[Text] Crows Nest, 28 Aug 92 (VDI-N)—Checking facial features by video camera could be a reality in a few years at international airports. An Australian research team has begun developing a system with which terrorists and other criminals could be quickly and reliably identified. In the process, the system is said to be so flexible that external changes to the face such as a beard or hair growth have no effect on the recognition process. Information scientists at the University of Bochum are working on similar systems.

Instead of a conventional computer program, for example an expert system, the core of this project is an artificial neural network (ANN). While expert systems are built on "if/then" relations and fixed programs are executed according to certain algorithms, artificial neural networks learn by example and repetition. They require no experts. They are trained until they produce the results desired. In the process, it is not important to know precisely what is going on within the network. The most tedious part of the programming is often the training process. However, once a system is trained, it operates very quickly.

Neural networks are especially suited for rapid data analysis of information which comes from different types of sensors. In addition to their speed, their strength lies also in that they can operate reliably with incomplete data.

"Their use in recognizing facial features, wherein the required data are furnished by a video camera, therefore

presented itself," explains John Fulcher, the team leader. His team is planning to develop a mosaic system in which only six different characteristics are stored: forehead, eyes, nose, ears, mouth and chin. Each of these categories will contain some 14 variations. With that, the amount of stored data can be reduced considerably. "We want to develop the system first of all on conventional DOS hardware using special artificial neural network boards," says Fulcher. Such boards which contain simple processor elements are available off-the-shelf. The board used by his team was made by Neuralware, a U.S. firm, and cost about DM26,000.

His team, which belongs to the Center for Information Technology Research at Wollongong University, south of Sydney, is carrying out the project together with the Societe Internationale de Telecommunications Aeronautique (SITA). SITA has made available about DM1.1 million and supports the project also by its own research at Sophia Antipolis in France. SITA is a worldwide organization which includes most of the international airline companies. The facial recognition system is only one of a number of projects in Australia which make use of artificial neural networks.

The Federal Ministry for Industry, Technology and Trade in Canberra is just in the process of publishing a report on the research and development projects which are concerned with artificial neural networks. Its author, Dr. Kerry Hubick, expects a dramatic growth in this area. He estimates that in the year 2000 the worldwide market for artificial neural networks could be worth DM6.5 billion while just a few years ago the market was practically nonexistent.

One of the most advanced projects in Australia is a system for improving pacemakers. Teletronics Pacing Systems, a Sydney firm, which has won an internationally leading role in pacemakers, and the Systems Engineering and Design Automation Laboratory of the University of Sydney have collaborated for this task. They are developing an artificial neural network which is capable of recognizing various heartbeat irregularities and taking the proper countermeasures.

Another project is underway by the road construction agency in Victoria, Vic Roads. Its purpose is to speed up road marking. The highest speed of current marking machines is around 40 km/h. The system developed and patented by Vic Roads can manage up to 60 km/h. Since the speed in the process is no longer limited by the signal recognition system, but only by the mechanical design, the agency hopes to reach 80 km/h.

The system has two cameras, one to track the road and the other for control. Both cameras send information to a common processor which then computes and disseminates the corresponding control signal for the mechanical marking system. Vic Roads is currently looking for a partner who can help make the system ready for production.

Another application of artificial neural networks is being pursued by the BHP, the largest Australian firm. The steel manufacturer is testing the possibility of controlling its blast furnaces with artificial neural networks. Angela Bowles, project manager, sees an attraction of artificial neural networks in that these networks can operate with incomplete data. "Sensors often fail at the high temperatures in a blast furnace, and the control system must then be capable of making the right decisions with the available incomplete data," she says. Alcoa, the aluminum manufacturer, Gemco, a manufacturer of ultrasound scanners, and the Center for Intelligent Information Processing Systems (CIIPS) have collaborated to develop a system that can be used in quality control for bauxite processing as well as rapid detection of flaws in railroad tracks.

The Center for Intelligent Information Processing Systems is also developing an image recognition system that is to be used in mail sorting. The center expects the next generation of sorting machines to be based on KNNs [artificial neural networks]. A prototype developed by the center allegedly now sorts mail already as fast as the prevailing optical sorting machines.

#### **Germans Said to Favor U.S. Over Domestically-Produced Supercomputers**

*92WS0818D Duesseldorf VDI NACHRICHTEN  
in German 28 Aug 92 p 15*

[Article by Bernhard Rose: "German Computer Manufacturer Complains of Bias; Emotional Barriers In Procurement; Supercomputer Users Show Little Confidence in Domestic Developments"]

[Text] Munich, 28 Aug 92 (VDI-N)—Supercomputers of German manufacture are finding it hard to stand up to foreign computers. Apparently, the belief that only Americans can master this technology is too deeply seated.

Falk-Dietrich Kuebler is angry. "The Americans have no more to offer than we do," complains the head of Parsytec GmbH in Aachen. The only German manufacturer of a purely European supercomputer that operates with numerous parallel processors had been completely ignored in public announcements for bids in Germany.

As the Juelich KFA [Nuclear Research Facility] ordered a new parallel computer from the U.S. competition a few months ago, Kuebler learned about it from the American press. The American Intel Corporation had quietly obtained the million dollar contract for its Paragon supercomputer which is still in the test phase.

The same deal now at the computer center at the University of Stuttgart (RUS) is infuriating Kuebler: "There we only learned of the procurement measures when the affairs had already been decided." By the end of the year, Intel is to have installed in Stuttgart, too, a

Paragon with 66 parallel processors fitted with Intel's latest chips, the PX-860. The capital investment is about DM3 million.

The Stuttgart scientists want to use the machine, which theoretically executes 5 Gflops (1 Gflop is  $10^9$  floating decimal operations per second), mainly for experiments in fluid mechanics. The scientists, however, assume only 10 percent as the performance efficiently achievable. Therefore, programs geared especially for massively parallel computers (MPP) are to be developed at the center.

The argument from Stuttgart over the GC (Grand Challenges), the German computer made by Parsytec in Aachen: It is true that the machine is "technologically highly interesting and sound," according to Alfred Geiger, the man responsible for the evaluation at the Stuttgart center. Because of delays in the new microprocessors for the computer, they simply do not believe that the computer will still be ready this year.

But Intel is clearly behind schedule with its Paragon. Like Parsytec, Intel wanted to have the Paragon on the market already at the start of this year. According to American sources, it is now supposed to be at the end of the year before the first computer is ready. Meanwhile, because of the difficulties, Intel had to even forfeit considerable new business. Geiger is convinced: "With Intel, we have the straight facts as to when the imponderables will be clarified."

The arguments drive Kuebler up the wall. He makes it clear that the new chip used by Parsytec in the GC machine, the T9000 transputer chip, a development of Inmos Ltd., a British firm, and manufactured by SGS Thomson, will, in the meantime, already be produced in pre-series. Moreover, the T805 computer chips currently used by Parsytec in the GC machine can even be later exchanged for the new T9000 processors. Also, the two compilers for software written in C or Fortran 77 were ready long ago.

Although the Aachen firm has successfully operated in the market for years with its parallel computers and has even sold them in the U.S. and Japan, Kuebler believes the problem is recognition. "People in this country simply do not believe that Europeans are capable of mastering this technology." It requires "an enormous amount of energy to change the deep-seated opinion against believing that such computers can be developed and built here too." In the process, the Aachen firm, by its own account, controls about 10 percent of the international market for parallel computer systems.

Highly parallel computer concepts were previously regarded as rather exotic; now established manufacturers are banking more and more on this new concept. Most recently, since the Bush administration in the U.S. raised the measuring stick of future supercomputers to at least a hundredfold more than current values at the start of last year with the teraflop initiative (performance of more than 1,000 gigaflops), an uncanny mood of awakening has reigned on the supercomputer scene: The

change from previous computer concepts with at best only a few parallel processors to massively parallel processing is entering into our time more and more clearly.

While an official stimulus was provided for the manufacturer in the U.S. with the teraflop initiative—the first computer in this class is being bought by the U.S. government—the European Community in Brussels can still wait with a decision.

Kuebler also sees a lack of national vision in Germany in the area of supercomputers. He says what is missing is “corporate agreement” on how important the “mastery of the discipline of high performance computing is for the competitive strength of the entire economy.” If Europe were not to master the subject, “it would simply have to be noted,” says Kuebler, “But we can.”

### French Plan To Recycle Automobiles Discussed

92WS0838C Paris *INDUSTRIES ET TECHNIQUES*  
in French 11 Sep 92 pp 57-62

[Article by Yves Ciantar: “Year One in Automobile Recycling: New Revolution in Design of Vehicles”]

[Text] PSA [Peugeot Corporation] and Renault are installing used-vehicle recycling units on an industrial-scale. In a nutshell:

- Currently, 75% of the weight of cars is being recovered. Raising this figure to 95 or 100% is another technical culture.
- Two approaches to the design of recyclable vehicles: Reduce the number of plastic materials; increase the use of clips for the assembly of components.
- A crushing line costs around 10 million francs [Fr]

It is 1998 in Duisberg, Germany. Karl Freundt inserts and turns the ignition key for the last time. The Model 1992 Volkswagen Golf sputters a bit—the ignition system has seen a great deal of service—but it starts up. With nostalgic hands, Karl Freundt drives his faithful old friend to his dealer. He parks it and drives away at the wheel of the new car he has just purchased. The next morning, a truck bearing the insignia “Volkswagen Recycling” loads the car aboard and takes it to the center at Leer, one of the used-car recycling plants that Volkswagen owns in Germany. There, a mechanical monster weighing all of 100 tons, a crusher, goes into action. It chops up the car into chunks of debris just a few centimeters in size. As the debris comes off the line, ultramodern sorting machines snatch up the pieces and sort them according to categories: morsels of rubber, chunks of crushed metal, bits of glass, shreds of colored plastic. Bought up by subcontractors, the fragments of plastic will be transformed into bumpers and fenders, the lead will be reused in new batteries, the recast metal will be fed to the steelmakers’ rolling mills, to, perhaps one day, become the frame of Karl Freundt’s next car.

Futuristic? The scenario may be to some extent. But Volkswagen will already be taking back its '92 vintage Golf through its dealers, at no charge, to be partially recycled. And while the dates and the number of recycling centers are imagined, the dealer-crusher-recycler chain described has every chance of being the one that will prevail by the end of this century. The very concrete Topfler Decree on automobile scrap—named after the German minister of environment who is turning everything topsy turvy—is to go into effect in 1993 in Germany. The four main points of the decree are: Automobile manufacturers must retrieve, at their own expense, at their customers’ premises, the vehicles they have manufactured, when these have reached the end of their useful life; the manufacturers themselves must organize and carry out the pick-up; recycling the scrap from automobiles will take precedence over their disposal as waste; and the recycled materials must all be reused within the automobile industry. This decree’s advanced thinking in terms of recycling helps explain why the foregoing scenario takes place in Germany. France, however, is not exactly bringing up the rear of this trend, even if, for the moment, no legislation looms on the horizon.

France’s automobile recycling history began in 1990. “We started from practically nothing,” says Daniel Froelich, one of the Regie Renault’s mainsprings in this field. At that time, we were already recovering 75 percent of the weight of an automobile; that is, almost all the metal. But to aim for 95 or 100 percent, we had to acquire a technical culture that we did not have. We recovered the manufacturing scrap in our plants, of course, but we had no knowledge of dismantling methods or of recycling technologies. “This is why, in 1990, all the manufacturers were willing to pay for the viewing. PSA, together with the French Scrap-Iron Company [CFF], installed a pilot vehicle-dismantling plant at Saint-Pierre-de-Chandieu, near Lyon. Renault did the same at Flins. Their experimental work involved small volumes of some 10 vehicles a day.

“At Saint-Pierre-de-Chandieu,” says CFF’s technical manager, Jean-Marie Del Vecchio, “PSA pursued two objectives. It studied the recycling of cars manufactured prior to 1990, which had not been designed to be recycled. And PSA’s engineers planned to draw lessons from the gathering of these data that they could use in the future manufacturing of more-easily recyclable cars.”

Today, in 1992, the pilot European installations are all drawing their conclusions. They are identical. First of all, the major automobile recycling problem stems from the use of plastics. Secondly, the economic viability of used-materials recycling and reutilization chains is far from proven. “A car contains more or less 10 different kinds of plastics,” says PSA’s Corinne Desnost. “Polymethyl methacrylate (PMMA) is used in the optical components of the headlights and in the car’s counters and meters; polyvinyl chloride (PVC) is used in the car’s batteries. Polyamide (PA) is used for spaghetti. Polypropylene (PP) is the material used for bumpers. And

certain parts of the body are made of SMC [Sheet Molding Compound] composites." All automobile parts include several types of plastics that are very difficult to separate from each other. Moreover, even if one succeeds in isolating them, they must still be recycled, and the methods are very difficult to master. SMC composites, for example, cannot be recast. And polypropylene loses its mechanical properties.

What is to be done? The manufacturers propose two solutions. "For cars that have not been designed with future recycling in mind," says Daniel Froelich, "two approaches can be implemented: Total recycling (one recycled part gives a new part) for the bumpers, the fuel tank, the seats, instrument panel, and hubcaps; and the rest, after crushing, to be processed for use in the production of energy." Only one pilot plant exists for processing automobile scrap for use in the production of energy. It is located at Saint-Pierre-de-Chandieu, where CFF has created a subsidiary jointly with France's number three cement manufacturer, Vicat, to burn RBA [automobile-crushing residues] in a cement plant. During dismantling, material to be sent to the crusher must be separated out from plastic materials, which are recycled integrally. This is a very delicate operation, as has been indicated by the sole experiments to date, namely, those being carried out by Renault and PSA on the recycling of bumpers. The two manufacturers plan to install a full-fledged recycling production line by the end of this year. Not without a price tag. "This has cost us all of Fr10 million," says Daniel Froelich. "The plan includes a crusher truck that will make the rounds of the dealers and pick up the bumpers. The bumper is chopped to pieces and taken over by CPP, a company specializing in recycling. CPP resells the chopped-up bumpers to a production unit owned jointly by Renault, Atochem, and Plastic Omnium. This is a highly complex unit that makes use of mechanical and chemical methods. At the output end of the line, granules are again obtained that will be reintegrated into new bumpers at the level of several tens of percent."

An experiment of this kind requires a heavy investment, collaboration among four industrial enterprises, and a high-technology-intensive R&D effort to debug the recycling production line. To say nothing of having to sensitize the dealers, who become scrap collectors. Economically speaking, all told, the operation rests on a razor's edge. Edouard Lanfranchini, head of recycling at PSA, says: "The technical problems will be resolved within one or two years at the latest. But gathering the bumpers, then tomorrow the fuel tanks, is going to cost a pretty penny. A collection system will have to be put in place, funds will have to be invested in additional production units, and the dealers will have to be trained. Under these conditions, we have set a very clear limit for ourselves." Installing a "total recycling" chain will require that the recycled materials issuing from the end of the line have the same properties, the same quality, and the same price as new materials.

Tomorrow, it will undoubtedly be easier to recycle plastics. At Leer (Volkswagen), Saint-Pierre-de-Chandieu, and Flins, designs have also been drawn that will improve the design of vehicles. "The number of plastic materials in automobiles will unquestionably have to be reduced," Daniel Froelich predicts, "accord- ing primacy to new forms of polypropylene that are easier to process. Access to mounted components will also have to be improved to facilitate the dismantling process." The use of screws and bolts as the means of assembling and mounting components will have to be abandoned to the maximum possible, and replaced, for example, by methods based on clips. And to facilitate identification of the materials, all composites will have to have engraved on them the nature of the materials comprising them. The federation of French equipment manufacturers, FIEV, is currently working on the problem. Renault and PSA have started introducing such markings on the composites used in certain vehicles, like the new model of the Espace and the 106. International standardization under the aegis of the ISO [International Standards Organization] is being instituted at the European level. Regulations are to be issued in this regard.

A full-fledged revolution can be expected to materialize in the industry's design and research divisions. Beginning in September, Renault will distribute to all its design bureaus a set of strongly recommended specifications. Its intent is to sensitize its specialists to the use of recycled materials in their future projects, and it will also contain recommendations with respect to assembly and mounting. And very soon, Renault's design engineers will be able to consult a data bank common to all European automobile manufacturers.

#### [Box p 61]:

#### French Cooperation

After the launching of the pilot sites in 1990, the automobile manufacturers are now building full-fledged recycling plants. In July 1992, the two principal French manufacturers, Renault and PSA, announced that they had shifted into high gear and were installing a jointly-owned industrial-scale automobile-recycling plant at Athis-Mons. The example comes from Germany, where the FRG's principal automobile manufacturers have already teamed up to study the recycling units of tomorrow. In France, the Athis unit will be capable of processing 200 vehicles a day beginning in September 1992. The venture rests on the expertise of CFF, privileged partner of the two French manufacturers.

#### Germany: Europe's Largest Hybrid Solar/Wind Power Plant in Operation

93WS0004A Duesseldorf VDI NACHRICHTEN  
in German 4 Sep 92 p 35

[Article by Lutz Bloos: "Power From Sun and Wind"]

[Text] The largest hybrid facility in Europe for power production from sun and wind was hooked up to the power grid at the end of August on the North Sea island of Pellworm. The photovoltaic solar cells contribute a maximum of 600 kW and the wind converters 400 kW to the overall capacity of 1 MW. The power generated is fed directly to the regional Schleswig grid. The experience gained from this demonstration project is intended to make a significant contribution to the optimization of future hybrid facilities.

A photovoltaic power plant with a peak output of 300 kW was put into operation as early as 1983 at the favorable wind and solar site on Pellworm. The solar modules have withstood an eight-year operation without breakdown under extreme climatic conditions. The power produced by the sun was stored in lead storage batteries with a total weight of 300 t and then withdrawn as needed to supply the resort center on the islands. The facility was expanded in 1986/87 by three wind converters of 33 kW output each.

In addition to doubling the photovoltaic capacity, in 1991 a 300-kW wind converter was erected. While the old solar modules remained standing, the accumulators, with a capacity of 6,000 A-h were dismantled after seven years, because they showed serious flaws in capacity. Instead, power is now being fed directly through current inverters to the local grid. The elimination of the batteries made it possible to construct the switching facility in a significantly simpler manner. The space saved in the operations building is now used for protective gear, switching and control facilities for feeding the grid.

The combination of wind and sun has a crucial advantage over strictly wind or solar power plants: Power production is significantly more even, and unwelcome output peaks and valleys, which must be compensated for in the grid, are much less pronounced. And in the winter, when photovoltaic power production is not abundant anyway due to the low position of the sun and short duration of the sunshine, the normally strong wind makes the principal contribution. The equalizing effects are not only noticeable in the annual rhythm, but, within limits, also in the change between night and day, because on the coast the wind blows at night as well and does not, as frequently inland, abate at night.

Clear progress has been achieved since 1983 in the efficiency of solar cells. A comparison of the old and new facilities shows this clearly. The efficiency factor of the polycrystalline silicon solar cells installed in 1983 is 9 percent, while the ones from 1992, with a 12-percent efficiency factor, are already one-third more efficient. This is immediately noticeable in the surface areas required: The old solar modules have a surface of 4,500 m<sup>2</sup>, while the new ones with the same output take up only 3,000 m<sup>2</sup>. The ground surface covered could be reduced even more drastically: from 16,500 m<sup>2</sup> to 9,500 m<sup>2</sup>. The angle of incidence of the modules, reduced from 40 degrees to 30 degrees, also contributed to this. This assures a better power yield primarily when the sun is

high in the sky in the summer, and permits a narrower space between the rows of module racks. The entire area even under the solar modules continues to be used as a sheep pasture.

The energy suppliers Schleswig and Telefunken Systemtechnik (TST), being the builders of the facility, have installed remote monitoring systems with which all the processes of the complex system can be controlled and documented. By these means the technicians want to gather data and experience in order to optimize other facilities, which in the future are to be built on islands with no connection to the power grid in order to provide a secure and continuous power supply. Principally, the effects of a high and simultaneously fluctuating inverter output on a relatively weak island grid are to be studied. The combination of wind and sun makes it possible to reduce the dimensions of emergency power units or batteries. This saves additional cost and thereby increases the competitive ability of combined solar/wind power plants in comparison with power production from diesel engines for island locations.

The operators anticipate an average power production of 1.5 million kWh annually. They expect a yield of 500,000 kWh of solar power and 1 million kWh from wind energy. This power yield alone surely does not justify an investment of about 9 million German marks [DM] in the Pellworm 2 project. Of this amount DM7.5 million is for the solar generators and DM1 million for the wind converter. DM500,000 are allocated to the test phase and operation during the first three years.

The construction of the Pellworm hybrid power plant was placed in the overall energy and environmental context by Undersecretary Bernd Neumann of the Federal Ministry for Research and Technology (BMFT). During the dedication of the facility he stated that it is important to seize all promising opportunities to reduce carbon dioxide. Market introduction of renewable energy sources must now be supported, as was also proposed by the federal economics minister. In his ministry's budget, Neumann explained, DM313 million are available for renewable energies, DM 95 million of which for photovoltaics. The BMFT assumed a share of 42 percent of the total cost of the Pellworm plant, the land of Schleswig-Holstein 20 percent, Schleswig 25 percent and TST 13 percent.

But all the renewable energies combined can only make a minor contribution to the reduction of carbon dioxide, Hans-Joachim Schiller, spokesman for Schleswig, explained. "Nevertheless, the efforts make sense," Schiller said, "because we are showing with them that we, as the FRG, want to be in the forefront of the development. But no one should nurse the hope that by using wind and sun we can turn off the power plants. We can only save fuel." Wind and sun do not continuously produce power, so that for periods without sun and wind the capacity of conventional power plants has to be available.

**Germany: CFC Substitutes Used in Environmentally Friendly Refrigerator**

*93WS0004B Duesseldorf VDI NACHRICHTEN  
in German 4 Sep 92 p 35*

[Article by Rainer Antkowiak: "Eco-Refrigerator Creates a Stir;" first four paragraphs are VDI-N introduction]

[Text] The refrigerator from the company dkk Scharfenstein, in Scharfenstein near Chemnitz, Saxony, is not a high-tech product—and that is precisely why it is interesting. The unit makes do without chlorofluorocarbons (CFCs), which destroy the ozone layer, and without fluorocarbons (FCs), which cause the greenhouse effect. The cooling agent, developed at the Dortmund Institute of Health, is a mixture of hydrocarbons with the principal ingredients propane and butane—in quantities which are no longer a lighter fluid. The polystyrene (EPS) insulating materials are expanded with pentane.

According to information from the dkk technicians, the unit will continue to be improved until its delivery next spring. The EPS thermal insulation is not yet optimal, the ideal oil has not yet been found for the cooling agent, and the dimensions of the evaporator must be altered. Even so, the dkk product is held to be a serious alternative to refrigerators using the toxicologically controversial fluorocarbon R 143a, which is favored by the international chemical industry. "Good marketing opportunities," admitted even Federal Environment Ministry Klaus Toepfer.

Meanwhile, the discussion about the eco-fridge has had an effect on the Trust Agency in Berlin. Instead—as originally planned—of closing the Saxon enterprise as quickly as possible, the refrigerator-makers are now being given 5 million German marks [DM] in order to convert the entire product range to environmentally compatible hydrocarbon mixtures.

Rarely has a household appliance attracted as much attention as the eco-refrigerator from the dkk company in Saxony. Although in many ways the unit must still be technically improved, it is considered a serious alternative to products using the cooling agent R 134a, favored by the chemical industry.

The eco-fridge from Scharfenstein in Saxony is more than just a piece of completely chlorine- and fluorine-free household refrigeration furniture. It is a sales hit before a production-ready model has yet to come off the assembly line at the dkk company. Not until April of next year, at a cost of less than DM700, will the company deliver something which tens of thousands of people have ordered in the past weeks during an advertising campaign by the environmental protection organization Greenpeace: a cooling device with 127 liters of usable space, 0.7 kW/24 h energy consumption and a guarantee of no ozone-destroying chlorofluorocarbons (CFCs). "The appliance from Scharfenstein has good marketing

opportunities," Federal Environment Minister Klaus Toepfer even said recently. The Neckermann mail order company will be offering it.

The unit is not exactly news for the manufacturer dkk. Instead of using the CFC R 12, as before, a mixture of propane, butane and cyclopropane, known as a "Dortmund mixture," transports the heat from the interior of the refrigerator. The appliance's insulation consists of expanded polystyrene (EPS), and the inflating agent for the foam is propane.

In contrast to chemical conglomerates such as Hoechst, ICI and DuPont, which tout the fluorocarbon R 134a as a replacement for R 12, Harry Rossin is concentrating on chlorine- and fluorine-free coolants. The head of the Dortmund Institute of Health and the inventor of the coolant mixture from three hydrocarbons does not think much of R 134a. "This substance breaks down in the atmosphere as trifluoroacetic acid," the bacteriologist says. "This in turn is degraded by anaerobic bacteria in the ground into monofluoroacetic acid." And it has been known for a long time that one drop in 10 liters of water is sufficient to kill a horse, if you let it drink the water.

Tony Kaye, sales director for German ICI in Frankfurt, has an entirely different view. According to Kaye, R 134a has been tested by international chemical companies in environmentally compatible studies by the Alternative Fluorocarbons Environmental Study (AFEAS). These studies have clearly showed, he said, that there are no problems whatever with the R 134 breakdown products. Says Kaye: "The amount of breakdown products is so small that it is completely irrelevant."

Small, at least, is the amount of coolant put into dkk's refrigerator—not even as much as in an average gas lighter. Right now, according to information by the company, one wants to come down from the present 30 ml total volume to about 20 ml. This way it would be physically difficult for an explosive mixture to form during a leak in the coolant cycle in the interior of the refrigerator.

Experts disagree on the energy consumption of the eco-appliance. "The allegedly higher energy consumption with coolant from hydrocarbons is a stubbornly remaining rumor," in the opinion of Holger Brackemann, a chemist with the Berlin Environmental Office. A series of studies have proven that on the precondition that the technology used is optimized, higher energy consumption should not be anticipated.

For dkk's technicians, optimization means working on the details, above all. Thus, the thermal insulation is not yet perfect. During production heat bridges occasionally develop from gaps in the foam. The refrigerator makers in Saxony have been foaming EPS "around the corner" for years. The foam material is injected between two preformed parts and serves simultaneously as thermal insulation and a structural component. The specific insulating effect of the EPS lies below that of foam propelled by CFC. For this reason people at dkk are



thinking about possibly reinforcing the insulation at the expense of the interior capacity.

Also on the list of technical improvements is the coolant. The final ratio of the principal components propane to butane has not been found; further, it has not yet been determined whether other hydrocarbons could also be used as coolant. Other alkanes and propyls are being discussed within the company.

Not lastly, it turns out that the "Dortmund mixture" and the moderately viscous mineral oils used—one is still looking for the ideal oil—do not sufficiently dampen the noise made by the compressor. The small amount of coolant is responsible for the fact that another evaporator must be developed.

"You are dealing with an appliance," an expert with inside information from Scharfenstein summarizes, "which is still worth improving on a large number of points." Its energy consumption is only in the medium range; appliances already exist today which need just 0.3 kWh/24 h of energy. In spite of everything, the technical improvements must be implemented before delivery begins next spring.

Meanwhile, the large amount of public attention devoted to the Saxon refrigerator has also had an effect on the Trust Agency in Berlin. Originally the Trust Agency had planned to close dkk down. Instead, although the dkk team is being reduced from 1,800 to not quite 450 employees, the company is being given DM5 million to convert the company's entire product range to environmentally compatible hydrocarbon mixtures. This guarantees the survival of the enterprise in a receiving company until the end of 1993.

#### German Firms Work on Filters to Lower Diesel Emissions

93WS0014A Stuttgart BILD DER WISSENSCHAFT  
in German Oct 92 pp 42-45

[Article by Ruth Henke: "Wanted: Clean Vest"]

[Text]

#### Technology

What truck manufacturers are doing against diesel soot! The highly praised three-way catalytic converter is not up to the task of solving exhaust problems in diesel vehicles. Now, a cool catalytic converter and a hot filter are to help out the diesel.

A simple test is enough to unmask the perpetrator. If you hold a white cloth in front of the exhaust of a running diesel engine, it will become black in a very short time. The cause is very fine soot particles resulting from incomplete fuel combustion. The government is also now on the track of these particles. Limits for the particle emissions from diesel engines have been in force since July. These limits are to be tightened by the end of this millennium in second and third phase. The exhaust

values allowed at that time require an innovative engine design—or a sophisticated exhaust cleaning system.

For a long time, the diesel vehicles were considered good for the environment because they produced less carbon monoxide (CO) and hydrocarbons (HC) than spark-ignition engines. The reason for this was that combustion of diesel oil requires a great amount of excess air. This improves oxidation of the carbon compounds. Only recently have diesel particles been found to be dangerous. The diameter of these particles is only a few ten-thousandths of a millimeter and permits them to propagate via the air like gas molecules. They may enter the lungs by breathing and may cause cancer there.

Rats, mice and hamsters, serving as test animals, had to breathe extremely high concentrations of diesel soot. These concentrations ranged from 0.8 to 7.5 milligrams per cubic meter of air. While the rats reacted with lung cancer, no tumors formed in mice or hamsters. Animal experiments up until now do not allow an unambiguous conclusion to be drawn. In spite of this, biologists and physicians from the Fraunhofer Institute for Aerosol Research in Hanover raised concern after multi-year tests. They said that "a slight cancer risk due to fine dust in higher concentrations could not be ruled out for humans at this time." In metropolitan areas, diesel particle concentrations averaging from 0.015 to 0.020 milligrams per cubic meter of air can be measured annually.

It would be very simple to reduce the soot. Merely raising the combustion temperature in the engine would be enough. Of course, the high temperatures increase the emission of nitrous oxides, which are also causing concern for the utility-vehicle industry. This irritant gas is partially responsible for acid rain and summer smog. Albert Wiesmeyer is a physicist from the Iveco Magirus Development Center in Neu Ulm. He talks about the dilemma of having to decide between a lot of nitrous oxides or a lot of particles. Oxidation catalytic converters and soot filters are to help the diesel.

Besides the soot particles, diesel exhaust contains as pollutants the unburned hydrocarbons (HC), carbon monoxide (CO), nitrous oxides (NO<sub>x</sub>) and sulfur dioxide (SO<sub>2</sub>). These gases can be rendered harmless by the catalytic converter. Like the three-way catalytic converter, the oxidation catalytic converter also consists of a honeycomb structure made of ceramic or metal coated with platinum or palladium. The toxic carbon monoxide and hydrocarbons are converted into carbon dioxide and water vapor on the coating of precious metal by being enriched with oxygen. The oxygen-rich exhaust promotes this process.

The high percentage of air in diesel exhaust does have disadvantages. On account of this, nitrous oxides cannot be catalytically converted into the inert nitrogen by removing the oxygen. Therefore, the oxides exit the catalytic converter unaffected. Even worse, the oxidation catalytic converter converts the sulfur dioxide contained in the diesel to sulfates. These precipitate onto the soot nucleus increasing the particle mass.

The combustion in an engine of one liter of diesel fuel containing 0.15 percent sulfur creates either 2.5 grams of



gaseous sulfur dioxide or 10 grams of sulfate mass. While a high temperature in the catalytic converter does eliminate the gaseous sulfur compounds, more unwanted sulfate particles form starting at 350°C.

The engineers are thus faced with the problem of creating a catalytic converter that remains cool even under a high operating load and still eliminates nitrous oxides. Automobiles and metropolitan-area busses only reach a catalytic-converter temperature greater than 300° in exceptional cases. For this reason, only these buses or community-based utility vehicles made use of the oxidation catalytic converter to a large extent until now. However, even the new German diesel automobile models are almost all equipped with an oxidation catalytic converter as standard. Big rigs, on the other hand, frequently reach peak temperatures of 500°C in the engine compartment. Oxidation catalytic converters are not suitable for these vehicles.

If a truck is to be equipped with a catalytic converter, it must have low-sulfur or sulfur-free fuel. Technically, the refineries are capable of producing diesel oil to this specification. However, they fear that a price increase could result in a drop in sales.

The economic researchers from the Arthur D. Little consulting office wanted to know exactly and came to the following results for the German market. Sulfur-free diesel oil costs only an additional 2 to 3 pfennigs per liter. The price per liter would increase only by 6 to 8 pfennigs if the potentially damaging aromatic compounds were also eliminated from the fuel.

The oxidation catalytic converter can reduce the particle mass by eliminating the hydrocarbons that are easy to precipitate. However, the soot nucleus remains undisturbed. This nucleus appears to be responsible for lung cancer according to the most recent studies. Uwe Heinrich is a biologist and deputy director of the Fraunhofer Institute for Toxicology and Aerosol Research. He demands, "that primarily the soot nucleus of the diesel particle be removed from the exhaust."

The catalytic converter was also supposed to take care of this particle. At about 550°C, the soot particle also ignites forming carbon dioxide, water and a small

amount of carbon monoxide. However, even the best diesel catalytic converter fails at about 500° and up.

For this reason, all large truck manufacturers are working "with a high priority on exhaust particle filters," says Wolfgang Berg, department head for exhaust-gas approval at Mercedes. Every filter must satisfy two tasks: collecting particles from the exhaust stream, and disposing of these particles immediately. If the filter becomes clogged, the exhaust back-pressure increases, the engine power drops rapidly, and fuel consumption increases.

Just like the catalytic converter, the soot filter consists of a ceramic frame riddled with a number of rectangular channels. These channels are alternately closed at their front or rear ends. As the gases flowing in meet closed doors at the end of the channels, they must find a path through the porous intermediate walls of the filter into the open adjacent channels. Seventy to ninety percent of all particles are trapped in this way. Many manufacturers such as Mercedes-Benz choose coarsened yarn made of ceramic fibers as the soot trap. This yarn is wrapped around perforated steel tubes.

This part of the filter system is simple and similar everywhere. The second task, burning the filters clean, is more difficult.

When the legislators in the mid-eighties first turned their attention to big rigs, the Research Ministry in Bonn believed "that the soot filter technology for heavy utility vehicles would be developed to a degree sufficient for series production by the end of 1989 and would then be used." This plan has proven to be a great error. At this time, the practical application of previously developed systems is being tested in a "large-scale soot-filter test" of the Federal Ministry of the Environment. For the last one and one-half years, 1500 different vehicle models equipped with filter systems from various manufacturers such as Mann and Hummel, Klockner-Humboldt-Deutz or MAN have been traveling the streets. These measured data and the practical experiences with the various filter systems will be consolidated in the Federal Office of the Environment. This office will evaluate the test in autumn 1993.

While the filters hold back almost all soot, only very few systems are low-maintenance. Most systems must be regenerated outside the vehicle or at least when it is stopped.

#### Throttling Exhaust

##### Limits for diesel engines in utility vehicles (in grams per kilowatt-hour)

	EC as of Oct. 90	Switzerland, Austria as of Oct. 91	EC guidelines EURO 1 as of July 92 or starting in Oct. 93		EC guidelines EURO 2 starting in Oct. 95 or Oct. 96
			At type approval	From series production	
Carbon dioxide	11.2	4.9	4.5	5.0	4.0
Hydrocarbons	2.4	1.23	1.1	1.25	1.1
Nitrous oxides	14.4	9.0	8.0	9.0	7.0
Particles	-	0.7	0.36	0.4	0.15

- The City Filter for new Volvo trucks and busses up to 280 HP is full after traveling a distance of 300 kilometers in city driving or 600 kilometers in highway driving. Then, the filter needs to be connected to an electric outlet. Three hours later, the built-in spiral heating elements have eliminated the soot. That is—as even the Swedish manufacturer admits—“not a perfect solution but a compromise.” It is also rather inexpensive at 16,000 marks. Up until now, Volvo has equipped about one percent of its utility vehicles in city and local traffic with the filter.
- The engine manufacturer Klockner-Humboldt-Deutz AG has developed a filter for diesel engines up to a maximum of 60 HP. This filter is used in fork lifts. Once the filter is full, it is removed and connected to a hot-air fan for the combustion process.
- The Eberspaecher company from Esslingen is making use of its years of experience with engine-independent automobile heating systems for its regeneration technology. To raise interest in the soot filter for all utility vehicles and not just for regular busses and trash trucks, cleaning combustion also must be possible while the vehicle is moving.

For this reason, Mercedes-Benz is also working on a filter system that cleans itself fully automatically during travel. One promising version appears to be a system having several filters. In such systems, one clean filter is available while the other is being regenerated.

MAN and the Leistritz company from Nuremberg have developed a double-filter system weighing just under 100 kilograms. This system also functions as a muffler. The energy for thermal regeneration comes from a diesel burner. The combustion process is started by a signal from sensors that measure the exhaust pressure.

Even the automobile industry is feeling increasing exhaust pressure. In the face of the American Clean Air Act of 1990, the Association of European Automobile Designers (ACEA) is storming about “limits for particle emissions that cannot be achieved with any tested technology.”

Even for passenger cars, it says there, the reliability of particle filters is questionable to a large degree. If “as continuous as possible regeneration and long operational life” is required of such a filter, even the Mercedes man Wolfgang Berg sees “no system even now,” that satisfies these criteria.

Speed is of the essence. In October, the strict U.S. particle limits go into effect in Switzerland for light utility vehicles, vans and off-road vehicles over 2.5 tons. Without a catalytic converter or filter, even the most advanced diesel engines must give up here over the long run.

### Germany: Electric Auto Field Test on Ruegen Island

93WS0017A Duesseldorf *HANDELSBLATT* in German  
5 Oct 92 p 13

["Battery Technology Remains the Key to Success"]

[Text] *HANDELSBLATT*, 3-4 Oct 92 fo Berlin—After almost year-long preparations, the official launching of a major field test of electrically powered automobiles took place on the weekend of 3-4 October on Ruegen Island. Through the period up to 1996 some 60 second-generation electric cars will undergo practical road tests in order to gain reliable data for the further development of this propulsion technology.

In the opinion of Professor Christian Voy, associated with the project coordination office of the German Automobile Society, this additional information is really needed to resolve the often controversial discussions concerning comparative emission studies of the various power plants. The new data is also necessary because existing information on electric vehicle technology is—to a good extent—already outdated.

Besides determining power and ecological factors under practical field conditions, the driving and operating safety of the upgraded vehicles (which nonetheless are built from mass produced components) will also be tested and, what is equally important, further experience and knowledge will be gathered on the technology on rapid battery charging, which is required in order to extend the operating range of such vehicles.

Ruegen Island in the Baltic Sea was chosen for this mass testing because, as a holiday resort, it represents a typical pollution-sensitive traffic zone on a small scale for which the ecological advantages of emission-free vehicles would be so beneficial. For the German Federal Ministry of Research, which is funding half (40 million German marks [DM]) the costs of the project, the selection of the Ruegen test site also has a political aspect. Owing to the island's median position between the eastern and western parts of the country, the considerable research and development work involved will further increase cooperation between the new and old German states.

Among the 60 electrically powered automobiles scheduled to arrive by mid 1993, are 37 automobiles, 20 vans or small buses, and three midibuses. The entire motor pool will consist of models built of already mass-produced parts. In this way, not only will the costs of the competition be kept down as compared with those incurred if completely new designs were participating, but industry, too, will be in a better position to meet the tight schedule.

The Deutsche Automobilgesellschaft mbH (Daug), an affiliate of Daimler-Benz AG and Volkswagen AG, was designated as the company responsible for the tests. The vehicle pool consists of eight BMWs (third series), 10 Mercedes Benz 190s, ten Mercedes MB 100 transporters,

three Neoplan metroliner buses, 10 Opel Astra Caravans, nine VW Golfs, and 10 VW Caravelle transporters.

The need to achieve a greater range of travel with electric vehicles has recently led to the development of new battery technologies, which will be tested in Ruegen daily. Various battery systems, including lead acid batteries in the maintenance-free lead gel variant, have become available from the ABB, AEG, Daug Hoppecke, and Varta companies, which are also participating in the tests.

Most importantly, however, new battery technologies like alkaline systems with a fibrous structure, the nickel-cadmium battery and the 210-V (FNC), sodium sulfur batteries (NaS) with 180-V total voltage, and sodium nickel chloride (zebra) batteries will be tested. Advanced three-phase current asynchronous motors with power ratings between 16 and 45 kW (22 to 61 hp) propel the vehicles.

Professor Voy continues to believe that battery performance is still the key to the successful operation of electric vehicles. The goal now is to examine these new-generation systems for the first time in comprehensive field tests. The few entries at Ruegen driven by lead batteries will serve only as reference objects against which to demonstrate the technical progress achieved in recent years.

The Ministry of Research in Bonn notes proudly that in the period from 1974 through 1996 it will have subsidized R&D on electric vehicles and its components to the amount of DM172 million. For the development of just one high-power battery the ministry since 1974 has allocated more than DM85 million. DM37 million has been allocated for electric buses, DM12 million for vans, and DM15 million for conventional batteries.

Caption: Three Daimler Benz companies alone are participating in the field tests on Ruegen Island: Mercedes Benz has entered 10 190s powered by electric motors and 10 MB100 electric transporters. AEG will show off its development of the entire power train, from the electrical power point through the onboard battery charger, battery system, and drive control to the E-motor itself, in which the ZEBRA batteries (sodium nickel chloride) are the heart. DASA (German Space Agency) developed a photovoltaic unit with a top power output of 20 kW.

#### Netherlands: Environmental Impact of Electric Car Assessed

93BR0020 Rijswijk POLYTECHNISCH WEEKBLAD  
in Dutch 24 Sep 92 p 1

[Article by Bart Stam: "Electric Cars Only Worthwhile in The City"]

[Text] The city is the only place where the highly praised electric car will have defeated the petrol-driven car by the year 2000. Outside urban areas, environmental advantages of the so-called "clean" vehicle will hardly

have fared any better than those of cars with a three-way catalyzer, according to a report entitled "The Entry of Electricity in the Transport Sector," issued by the Center for Energy Saving and Clean Technology in Delft. The agency appeals for the selective use of electric vehicles in the future.

"It appears from our findings that it will not be possible to use electric vehicles on country roads," said M. Ederman of the Center for Energy Saving and Clean Technology (CE). Together with colleagues Van den Haspel and Haverkorn, he had carried out an in-depth investigation on behalf of the Cooperative of Electricity Producers (SEP) and EnergieNed (the association of energy distribution concerns) on environmental effects and user costs which result from the use of electrically driven road transport. According to the CE, the high costs of electric-driven transport will be a serious hindrance for any large-scale introduction by the turn of the century. In the short term, therefore, the demand for electricity will not increase dramatically. This also means that SEP will not need to build any new power stations.

#### Many Kilometers

Although private cars are by far the largest group of vehicles, the CE does not only scrutinize the motor car. Trucks, buses and vans are also examined. "The general tenor of our investigation shows that motor vehicles which run on electricity must cover many kilometers in order to be able to prove their environmental advantages," said Elderman. That is because, among other things, the battery system has to cope with a loss in power while the car is standing still. The CE has calculated that an electric car with a high-temperature sodium-sulfur battery loses about 90 watts for every 100 kilometers. The sodium-sulfur (NaS) battery is favored to replace the present lead-acid battery because it has a much higher energy density. This allows a much wider action radius. The electric engine can ensure an approximate 80-percent reduction in acids released from trucks. This is as a result of the high emissions from the present turbo-cooled diesel engines. Emissions from vans are similar to those from private cars.

The Delft agency states that taxis and courier services, in particular, will benefit from the electric engine. Outside the city the electric car scores less well because the turnpike performance of the gasoline engine shows a higher efficiency than that of the electric motor. In built-up areas, where drivers frequently have to stop and start, the electric car stores its braking energy and uses it for driving. Outside the city this advantage is much smaller because the driving speed is much more constant.

It is noticeable in the investigation that the "hybrid car," under experimentation by German concerns such as BMW and Volkswagen, shows up badly. The hybrid car has both a diesel and an electric engine. Inherent disadvantages of this car are the extra weight of the battery

and the space required for the two drive shafts. Electric cars that make use of a current collector or pantograph are more suitable for use in nonurban areas. Such a car attaches to an electric wire placed above the road. This science fiction system is comparable to the trolley.

It looks as though an electric car with a range of 100 kilometers performs best at an annual mileage of 16,000 kilometers, particularly if it remains in the city. Taking into account [increased] emissions of electrical power plants, carbon dioxide emissions from these cars amounts to 60 percent and about half the amount of the nitrogen oxide from a normal car. When the electric car is equipped with a larger battery or spends much of its time outside towns, then these percentages approach those of the combustion engine. The CE comments that 70 percent of driving is done outside the city.

#### Extra Costs

The hybrid car, however, is cheaper than the other electric cars as a result of its smaller battery. The extra costs are about 18 cents per kilometer, whereas that of electric cars with a large battery amount to almost 25 cents. The CE points out that it is difficult to calculate exactly how much the costs will be in eight years. It is unclear what is going to happen to the present customs duties, value added taxes, and the special luxury tax on private cars. At the same time, the future price for batteries and electric engines is uncertain. The people at the CE are assuming that the price of the NaS battery will be about 600 guilders per kWh the year 2000, which is four times less than it is now. A price of 380 guilders per kilowatt is estimated for electric engines. The gloomy

prediction is that, "In all cases the operation deficit per kilometer driven will be large." "Electric cars are far from being cost-effective."

#### [Box]

#### Clean or Not

Whether large-scale use of the electric car is good for the environment or not depends to a great extent on how the electricity is produced. In Norway, where there are many hydro-electric power stations, the electric car would produce sulfur (SO<sub>x</sub>) emissions which are about 96 percent lower, but in the United Kingdom, SO<sub>x</sub> emissions would be 31 percent higher. In Belgium, NO<sub>x</sub> (nitrogen) emissions would go down by 70 percent, and in Greece, only 21 percent.

G. Douin, representative of the Association of European Automobile Manufacturers, presented these figures this week at the "Emission 2000" conference in Brussels.

The European Community is attempting to attain a drastic reduction in car emissions by 1 January 1993. By then emissions must be from 70 to 90 percent lower than in 1970. Electric cars are potentially the only vehicles which will be able to carry the ZEV [Zero Emissions Vehicle] designation, as long as the electricity is "clean." But the expectation is that a total changeover to electric cars will take about another 30 years.

According to Prof. A. Morelli, senior lecturer at the Technical University of Turin, the fastest way in which to reduce emissions is simply to have your car regularly serviced and properly tuned. That alone will produce 30 percent lower emissions.

**Environmental and Economic Impact of Electric versus Combustion Engine Cars**

Private car, 16,000 km/year	CO <sub>2</sub> emission	NO <sub>x</sub> emission	Operational deficit
Electric city car, action radius of 100 km	59%	52%	16
Electric city car, action radius of 200 km	76%	68%	24
Electric car, 50% city use	81%	64%	18
Hybrid car, 50/50 electric/combustion engine	91%	86%	13
Electric car, 50-percent current collector	89%	70%	18

[Caption] The comparison is made with a 100-percent tuned-up combustion engine equipped with a three-way catalyzer. This table only contains CO<sub>2</sub> and NO<sub>x</sub> emissions, other emissions were not taken into account. The operational deficit refers to the extra cost of an electric car versus a conventional car, without taking into account value-added taxes, customs duties, and other consumer taxes.

#### France: CEA Opens Pilot Nuclear Waste Furnace

93WS0020E Paris AFP SCIENCES in French

24 Sep 92 pp 24-25

[Unattributed article: "CEA Melts Nuclear Past"]

[Text] Marcoule—The scene per se is nothing special compared with what one might see in any steel plant: molten metal being poured out of a furnace casts a strong light on the surroundings and, several meters away, it heats the glass panes that separate it from the nearby control room so that you can hardly touch them.

This scene would be quite commonplace, except that it takes place at the CEA [Atomic Energy Commission] Marcoule (Gard) facilities, and the steel being processed into ingots comes from the G2 and G3 reactors set into service during the fifties to provide plutonium for France's first nuclear weapons, and which are being dismantled now.

The two reactors, which used the so-called UNGG (natural uranium-graphite-gas) system also produced electricity: prior to their final shutdown, in 1980 and 1984 respectively, they provided 12 billion kWh

[kilowatt/hour] between the two of them, each having a power output of 38 MWe [megawatts/e].

On 16 September, about five months after it started operating, on 27 April, the furnace began to "gobble up" the second thousand metric tons of steels from the French nuclear past.

"In 20 years," the CEA fuel cycle manager, Mr. Jean-Yves Barre, sighed, "we have acquired expertise that causes us to believe that dismantling, i.e. the various operations performed when a facility is shutdown for good after nuclear material removal—disassembly, cutting, confinement, waste disposal, etc.—is perfectly manageable. Both with respect to safety and technically, especially considering that we use mostly already existing methods."

While dismantling six research or pilot reactors and eight laboratories or plants, the CEA has developed know-how which, for the time being, is of merely theoretical interest for nuclear power-plant operators although we already know that it will take on a major industrial dimension during the next century.

EDF [French Power Company], for its part, is setting aside 15 percent of each reactor construction cost, plus the cost of inflation over 30 years; 16 billion French francs [Fr] were thus provisioned by the end of 1989. The full dismantling of a power plant is estimated to cost about Fr200 million.

When a nuclear facility is no longer operated, three degrees of dismantling can be considered: mere shutdown and monitoring after removal of the most highly radioactive materials (level 1); partial and conditional release of the site and bringing it to level 2 (radioactive containment area reduced to a minimum, reinforced protection against radiation). Finally, total and unconditional release of the site after removal of anything still more radioactive than the maximum permissible doses for the public, and eventual reuse of the site, without any restriction (level 3).

To go from level 1 to level 2, all that is needed sometimes is waiting. "This is usually the option chosen by EDF," Mr. Barre noted: within 50 years, the radioactivity of short-lived radioelements will decrease by a factor of 1,000. This solution obviously is not suitable for facilities containing long-lived elements with half-lives measured in millions of years. In that case, Mr. Barre explained, the strategy imposes thorough cleaning from the start, and also whenever increased risks of corrosion and radioactive leaks are present.

No matter what solution is adopted, however, one problem is unavoidable: waste and the volume of waste. For this, the Marcoule furnace shows the way. Thanks to this pilot facility, only 5 percent of the steel initially contaminated will have to be stored by the National Agency for Radioactive Waste Management [ANDRA]. The rest will just be stored; eventually it may be recycled in the nuclear industry. Or even in the industry at large,

if the psychological barriers that preclude any serious consideration or such reuse could be overcome, an expert pointed out.

### **Largest European Solar/Wind Power Station Operating in Germany**

93MI0038 Bonn *TECHNOLOGIE-NACHRICHTEN*  
*MANAGEMENT-INFORMATIONEN in German*  
18 Sep 92 p 7

[Text] What is currently Europe's largest combined photovoltaic and wind-powered hybrid power station went into operation on 21 August on the North Friesian island of Pellworm. The plant has an overall peak capacity of 1 MW<sub>peak</sub> windpower [as published], made up of 600 kW<sub>peak</sub> photovoltaic power and 400 kW windpower.

The hybrid power station developed in three stages. The first was the completion, in 1983, of a 300-kW<sub>peak</sub> photovoltaic power station on Pellworm, funded by the EC and the BMFT [Federal Ministry of Research and Technology]. The second stage was the expansion, in 1986/87, of this plant into a hybrid system through the addition of three windpower plants, each with a 30 kW<sub>peak</sub> output. Experience of operating this system led to plans being prepared in 1990 for the third stage, based on a new concept (direct feeding into the grid) without battery storage). The power station was enlarged by an additional 300-kW<sub>peak</sub> field and another 300-kW<sub>peak</sub> wind generator, thus providing a photovoltaic and wind-powered hybrid power station with 1 MW<sub>peak</sub> capacity. Work began on this third stage on 15 August 1991, and has just been completed, one year later.

This 300-kW<sub>peak</sub> extension to the photovoltaic plant cost around 7.5 million German marks [DM], 50 percent of which was contributed by the BMFT, 20 percent by the Land of Schleswig-Holstein, and 30 percent by the "Pellworm 2 Solar Plant" consortium, which comprises Telefunken Systems Engineering GmbH and Schleswig AG. The EC also funded the overhauling of the existing parts of the plant. The additional wind generator is being financed under the 250-MW wind program by the BMFT and the Land of Schleswig-Holstein. The aims pursued in the expansion of the Pellworm hybrid power station include:

- Comparative studies of different generations of solar modules on a large scale in field conditions;
- Proving the viability of the major advances achieved since 1983 in photovoltaic technology: Greater efficiency now means that only 2,500 m<sup>2</sup> active solar cell surface are needed for a 300 kW<sub>peak</sub> output, instead of the 4,600 m<sup>2</sup> previously required, thus substantially reducing the ground space requirement;
- Research into the operation of large-scale solar/windpower plants in conjunction with the power grid. The combination of 600 kW<sub>peak</sub> photovoltaic output and 400 kW<sub>peak</sub> wind output is intended to provide more constant output, both over the year as a whole and between day and night.

- The 12-pulse inverter used for the new plant and the pulse-width modulated inverter used for the new photovoltaic field, through which the current is fed into the grid, are intended to minimize harmonic load in the grid.

The experience acquired with this pilot project will be of considerable importance if larger outputs from photovoltaic and wind-powered stations are to be fed into the German grid in the future. This is why the project is being covered by a BMFT-funded metering and evaluation program and simulations to optimize future designs.

#### **Sweden: ABB Develops Environment-Compatible Solid-Fuel Firing System**

93MI0049 Wuerzburg *UMWELTMAGAZIN*  
in German No 10, Oct 92 pp 76-77

[Text] Western European power generators have only just succeeded in substantially reducing pollutant emissions from industrial furnaces by introducing the latest environmental technology on a massive scale, and now the electricity and heating industry is already facing a new, even greater challenge. Carbon dioxide emissions, whose build-up in the atmosphere is 50-percent responsible for the greenhouse effect, are to be reduced by a quarter of their 1989 level by the year 2005.

Increasing efficiency is the "magic formula" for increasing the yield of useful energy while stabilizing carbon dioxide emissions. The Vartan district heating works in Stockholm has given an impressive demonstration of how this can be done. This plant is the first in the world to operate on the PFBC principle which was developed by ABB in Sweden. The abbreviation stands for "Pressurized Fluidized Bed Combined Cycle."

Pressurized combustion has a large number of advantages over combustion at atmospheric pressure. Firstly, the stringent German emission directives can be complied with in exclusively coal-fired combined cycle power stations, even if they use coal with a high sulfur content and have no downstream flue gas desulfurization facilities; this is because the sulfur is bound in the combustion chamber itself by adding lime.

The nitrogen oxide incidence is kept in check by low combustion temperatures. The most important point, however, is that PFBC power stations have a 20- to 30-percent higher electricity output than conventional boiler plants of the same size, and a 10- to 15-percent lower fuel consumption.

These marked improvements are the result of an efficiency increase of about 40 percent—a value that has previously been achieved only with modern natural gas-fired combined cycle power stations.

Intensive work is already being done to develop the PFBC process further. Gradually increasing the steam pressure and temperature and raising the gas turbine

entrance temperature above its present level of around 830°C may improve efficiency again by as much as 5 percent.

#### **Germany: Alternative Materials for Solar Cells Studied in Berlin**

93MI0062 Bonn *DIE WELT* in German 10 Oct 92 p 9

[Article by Wolfgang Asche: Solar Electricity From Pyrite—Alternative Solar Cell Materials Will Make Better Use of Light“]

[Text] Conversion of sunlight into electricity is becoming ever more widespread: For instance, the Italian electricity company Enel plans to commission a 3-megawatt photovoltaic power station—one of the largest in Europe—near Naples.

Silicon, from which such solar cells are made, is far from being the ideal material, however. "Silicon's light absorption is pathetic," complains Dr. Wolfgang Kautek of the [German] Federal Materials Research and Testing Agency [BAM] in Berlin.

Kautek is therefore working on alternative solar cell materials that will be able to convert light into electricity with greater efficiency. The "thin film solar cells" thus produced are only a few thousandths of a millimeter thick—around 100 times thinner than silicon cells. Furthermore, they can be inexpensively precipitated onto suitable substrates, thus obviating the need for costly crystal growth processes or the time-consuming task of slicing the crystals into thin wafers.

The BAM's research focuses on what are known as compound semiconductors, which are composed of various elements, such as copper indium selenide ( $\text{CuInSe}_2$ ) or iron sulphide (pyrite,  $\text{FeS}_2$ ). The BAM plans to work with the Fraunhofer Institute of Materials Physics and Coating Technology in Dresden to produce ultrathin solar cells using these silicon substitutes.

$\text{CuInSe}_2$ , which is already being produced commercially by companies such as Siemens Solar Industries in California, is currently the most promising of these materials. Stuttgart University's Institute of Physical Electronics [IPE] recently claimed that "the 14.8-percent efficiency of our  $\text{CuInSe}_2$  thin-layer solar cell exceeds all values published to date."

Monocrystal silicon, however, can now convert up to 16 percent of incident light radiation into electricity and considerable further research will be needed before silicon faces a serious challenge. Dr. H.W. Schock of the IPE nevertheless takes an optimistic view: "In the light of the parameters achieved with our cell configuration, we expect further increases in efficiency."

### **Stockholm Buses Using Hybrid Gasoline/Electric Engines**

*93WS0063B Stockholm NY TEKNIK in Swedish  
24 Sep 92 p 5*

[Article by Lars Eriksson: "Gasoline-Powered Electric Buses Cleaner"—first two paragraphs are NY TEKNIK introduction]

[Text] Greater Stockholm's local traffic authority is investing in gasoline-powered electric buses.

SL [Greater Stockholm Public Transport Company] will order a total of six hybrid buses from Scania and Denmark's DAB.

Denmark's DAB and Saab-Scania will each deliver three hybrid buses to SL. Another six or seven buses may be purchased at a later date.

SL has been carrying out its own development work on this type of bus for several years. The buses that are now being ordered will be based largely on the concept SL has developed.

Two years ago SL rebuilt a battery-powered electric bus and equipped it with a generator and a car engine with a catalytic converter. Tests with the bus showed a nitric oxide emission of 1.15 g/km and a hydrocarbon emission of 0.44 g/km.

"That is 20 times cleaner than the best diesel bus on the market," said Kristian Julen who supervised the hybrid bus project at SL.

He believes the hybrid buses can be 50-60 times cleaner than diesel buses. And he did not consider it unlikely that the buses will eventually be able to meet the tough California requirement of a maximum hydrocarbon emission of 0.04 g/km.

The hybrid bus is equipped with a regular automobile engine which runs a generator. This in turn charges a battery which provides the driving engines with power. When the bus is braked, the electric motor also acts as a generator and charges the battery.

The advantage of this system is that the gasoline engine can be turned off in sensitive areas such as Stockholm's inner city. The bus then runs solely on the energy it has stored in the battery.

The electric power in the SL-built hybrid bus consists of two parallel systems with two series-wound motors of 55 kW each.

The coupling gears bring together the power from the two electric motors and also gear down the number of revolutions so the bus can start.

The gasoline engine is an ordinary 2.3-liter 16-valve model from Saab-Scania.

"The life span of this kind of engine will probably be only three years. But that will give us an opportunity to exchange and modernize this component if we want to," Julen commented.

The battery is a relatively expensive nickel cadmium battery made in France. It weighs 660 kg.

"This type of battery, which is handbuilt, costs between 200,000 and 500,000 kronor. We think the price could go down to perhaps a fifth of that with mass production," said Julen.

It is estimated that hybrid buses will be 20-30 percent more expensive than conventional busses.

### **Bavarian Trade Minister Funds Thermoelectric Converter**

*93MI0096 Bonn TECHNOLOGIE-NACHRICHTEN  
MANAGEMENT-INFORMATIONEN in German  
12 Oct 92 p 17*

[Text] A newly developed thermoelectric converter can generate power and heat from nearly all fuels. TEK, the abbreviation given to the heat engine operating on the Stirling engine principle, runs on gas, oil, methanol, hydrogen, and—if gasification units are fitted—with lignite, hard coal, organic waste, and even sewage sludge.

For many decades, work has been under way worldwide on the development of an efficient Stirling engine. With TEK, the breakthrough now seems to have been achieved in overcoming the major sealing problems posed by the separation of combustion and engine and developing a marketable solution that can also be used in large-scale systems.

TEK meets the stringent exhaust fume reduction requirements with which modern heating systems must comply. TEK causes little noise, requires little maintenance, and has a long service life. Oil changes are not required, so the problem of disposing of sump oil does not arise. As a result of its highly sophisticated engineering, TEK achieves about 90 percent overall efficiency. This very high energy yield make for lower fuel consumption and, consequently, reduces exhaust emissions.

The operating principle is as follows: With a conventional combustion engine (diesel engine, Otto engine) in which the fuel-air mixture ignites as in an explosion after each compression, high flame temperatures are reached, thus giving rise to a high level of nitrogen oxide emissions; several thousand such ignition operations take place every minute. A Stirling engine, on the other hand, combines the advantages of a heating boiler (uniform combustion with low flame temperatures and hence low nitrogen oxide values) with those of a piston engine in order to produce a rotary motion.

The primary object of the development, which was funded by the Bavarian Trade Ministry, is a combined

heat and power generator that presents technical advantages over conventional block-type thermal power stations involving combustion engines and achieves much better exhaust fume values.

Bavarian Trade Minister Lang has praised TEK's wide-ranging application potential. For example, the converter can be used as a stationary combined heat and power system supplying power and heat to factories and apartment and office blocks, as a stationary or mobile engine, as an energy converter in heat storage systems, or as a solar power generator. TEK is of modular design and can be extended to form larger units.

The machine was developed by Magnet Motor GmbH and subsequently by its sister company, Heidelberg Motor GmbH in Starnberg near Munich.

The Bavarian Trade Ministry granted a 50-percent subsidy under the "Bavarian Rational Power Generation and Consumption Program" for the project, which cost about 4 million German marks.

In the course of the five-year project, the Starnberg company also developed a thermo-hydraulic converter (THK) to prototype stage. In the THK, a gas-oil reciprocating pump replaces the working cylinder of a Stirling engine. The simple design principle has already proved viable in practice. Both projects received scientific support from Prof. F.X. Eder, who has already obtained numerous patents for his inventions, both in Germany and abroad.

## FACTORY AUTOMATION, ROBOTICS

### Germany: Visual Sensors Used to Check Surface Quality

92WS0775C Duesseldorf *HANDELSBLATT* in German  
13 Aug 92 p 18

[Article by Ulrike Fischer: "Image Processing/Visual Sensors Monitor Surface Quality—Inspection System Detects Errors Not Visible to the Human Eye"]

[Text] "A type of leisure time activity," that is how Dr. Bertram Nickolay of the Fraunhofer-Institute for Production Facilities and Design Technology (IPK) in Berlin characterizes his first journeys into the field of gray scale analysis five years ago. Today, he is able to use the whole range of the 256 tones available between white and black even under harsh production conditions. And that in a field, where he sees the future of image processing: in surface analysis.

To Bertram Nickolay, reducing waste was a true challenge. In the casting industry, the image processing expert found the objects suitable for testing and perfecting his development in the field of automatic surface inspection under extremely difficult conditions. Gray scale analysis of gray casting surfaces—a task which may be breaking records.

Like everybody who worked on the industrial application of visual sensors in the early eighties, Nickolay started in the field of object identification. The machine was supposed to recognize parts, their shape, size or position. The goal was to automate the material flow by robot vision.

### Optimum Results With Small Computer Power

Industrial research into image processing had just begun. The hardware was bulky and expensive. Initially binary image system, i.e. black and white, had to be used. By now, Nickolay has developed a method for surface analysis which allows varying the number of gray scale tones—as finely as possible—depending on surface or texture in the industry term.

In plain English: Some structures require less, others require more precision. The reason: to get optimum results with as little computer power as possible. This makes it possible to use image processing for a field which has gained increasing importance in the past few years: automatic quality control.

Take, for instance, the textile industry. At present, the rolls with the woven or knitted material are transported from the machine tools to display are as where they are rolled open and inspected again, mostly by women. The inspection system developed by Bertram Nickolay can classify up to 50 types of errors on textiles, using extremely fine differentiating characteristics which are hardly noticeable to the human observer. Based on its knowledge programs, it can also be operated by people trained on site.

To be able to recognize a texture and to distinguish its specific structure—dots, patterns or grain—from defects, a tear for instance, the system needs to perform two tasks: using complex mathematical procedures it compares the gray tones of the surface to be inspected, their accumulation to form specific combinations, and the frequency and the rhythm with which these accumulations change or remain the same.

Based on these and other calculations, the characteristics of a surface are calculated, similar to the analysis of fingerprints. Each error-free texture and each error yields a specific mathematical result. About 20 different methods of gray scale analysis are known: which one is selected depends on the type of texture.

Secondly: To be able to calculate the fingerprints of a surface and to distinguish them from errors the system has to "look the right way." It must evaluate the surface in the right direction based on its characteristics: the gray scale analysis procedures suitable for the texture have to be selected.

### The System Has to "Learn" to Look the Right Way

The steps with which the camera scans the surface have to have the right size. If they are too big or too small for the characteristic structure of a surface or an error, the



system does not recognize anything or overlooks important features. Only an image processing expert can teach the system how to look and evaluate properly.

Now that the development has been perfected in the laboratory, talks are underway with potential users from the textile industry and manufacturers of imaging technologies to adapt the software and hardware to industrial requirements. Writing error protocols, its evaluation, immediate error messages during the production process—all that is possible. Other potential applications are under consideration: The evaluation of ultrasound pictures which are used for diagnosing potential rejection reactions after pacemaker implants are being tested in cooperation with the German Cardiac Center in Berlin.

#### **Shortened Assembly Cycle for Manufacturing A340 Airplane**

93WS0001A Paris *TECHNIQUES ET EQUIPEMENTS DE PRODUCTION* in French Sep 92 p 12

[Article entitled "Just-In-Time Furnishing of the A340"; first paragraph is *TECHNIQUES ET EQUIPEMENTS DE PRODUCTION* introduction]

[Text] By combining interior fitting and final assembly at one site in Toulouse, Aerospatiale is able to shorten the manufacturing cycle one month.

As part of a plan to rationalize production of the new Airbus A330/340s, the job of fitting out the airplanes' interiors was given to Aerospatiale's Toulouse facility. Until now, the task had been the specialty of Deutsche Airbus in Hamburg, while the French airplane maker was responsible for the final assembly of all Airbus planes.

The new system enables Aerospatiale to install the airplanes' engines at the last possible minute before delivery, thereby saving substantially on in-process inventory (the four engines on the A340 represent 25 percent of its price).

Another significant advantage is shortened cycle time. "At the rate of seven planes a month—which we will reach in 1995—combining final assembly and fitting-out work at the same plant will save us one month of the four that were required until now," says Gerard Zuber, who is responsible for coordinating commercial airplane assembly for the Airbus A330/340s. This is a substantial gain in time, attributable largely to the elimination of round trips between Toulouse and Hamburg.

On the other hand, much is still hanging on the decision to combine the two tasks, which Aerospatiale made just two years ago. "The furnishing and equipment of the A340 is just as much a problem of logistics as technique," says Gerard Zuber. "We are about halfway there: We are just getting started at it and should be operating at full capacity in barely two years."

The interior outfitting of such a plane, which is never the same twice, involves the assembly of 8,000 parts, or 12 to 15 metric tons of materiel (service equipment, baggage compartments, etc.). The work is organized into kits. The parts are shipped in containers by Airbus's German partner, which still acts as chief contractor for the job. The outfitting of an airplane requires 70 containers, or, in the long run, a stock of 1,000 that Aerospatiale will have to keep track of between Germany and France. To minimize fixed asset costs, parts will be supplied in tight flows (just one week before they are needed).

Besides having to construct an assembly hall costing nearly 500 million French francs [Fr] and designed specifically for the job (seven parallel assembly stations, supplied with assembly kits via a common ledge as high as the cabin), Aerospatiale required the assistance of 40 Germans who are lodged in house in Toulouse.

Aerospatiale pooled its knowledge of final assembly lines and the know-how of the Germans to compress turnaround time even more. As a result, the A340 will be outfitted in 20 days instead of the 24 its German partner spent, on an airplane that was bigger. This gain in time is due to the greater versatility of the French assembly teams, which will put together an aircraft from A to Z and inspect their own work.

#### **Sulzer in France Adopts Just-in-Time Procedures**

93WS0001B Paris *TECHNIQUES ET EQUIPEMENTS DE PRODUCTION* in French Sep 92 p 32-34

[Article by Daniel Chabbert: "Sulzer Spends 30 Million Francs to Switch to Just in Time"; first paragraph is *TECHNIQUES ET EQUIPEMENTS DE PRODUCTION* introduction]

[Text] To set up a just-in-time system of production, Sulzer France simply rearranged its shop floors, without making substantial investments in equipment. Employee training was one of the most important factors in the company's success.

Restructuring and management changes gradually put CCM Sulzer back on its feet between 1984 and 1987. At that time, the French subsidiary of the Swiss group, which is located in Mantes-la-Jolie in the Yvelines, was involved in three businesses: diesel engines, pumps, and boilermaking. To improve the efficiency of the factory, Xavier Craplet, the company's industrial director at the time, decided to change the way it operated with the help of the PBA firm. "Huge investments had been made over the last few years," says Philippe Blin, production manager. "The company had extraordinary potential, but used it to poor advantage. The shop floor was organized by business and lost in productivity what it gained in flexibility. Diesel engines, for example, had to be delivered in nine months, though they required a manufacturing cycle of 13. That meant we had to keep stocks."

There was only one way to reduce stocks and turnaround times: just in time. The following year, management decided to take the plunge and set aside a budget of 30 million French francs [Fr] to study the new shop site, move the machines, and inform and train employees in the new work methods. Reckoned to last only a few weeks, the just-in-time setup period actually wore on for several months. In the meantime, the Swiss group sold off some of its businesses, including the biggest one at the Mantes-la-Jolie plant, diesel engines. Implementing the new methods could have slowed the breakup of the company, but instead proved to be of crucial help. The shop's organization into "non-overlapping basic units" (machining of the cylindrical blocks, connecting-rod cotter ends, furnace ends, piping preassemblies, and so on) made it easier to divide up the machines. Only a few machines had to be moved to different places.

"To implement just-in-time procedures, we had to move 80 machine tools. Only four big pieces of equipment, including a portal milling machine, stayed where they were," says Philippe Blin. "Despite the separation of the businesses, the three companies still work together, notably by exchanging subcontracting."

The diesel engine business, which is the largest and best structured (350 employees, including 240 in production) has taken the name of Sulzer Diesel France. Over 98 percent of what it produces is earmarked for export, and involves short runs (one to six engines per order) and long production cycles (about nine months).

"Grouping the machines by product instead of by function when we implemented just-in-time procedures reduced the travel time of parts by a factor of three to 10," notes Xavier Craplet, who is now general director of Sulzer Diesel France. "An engine that took seven months to work its way across the shop now does so in only four. The surface area of the facility has dropped 30 percent, parts in course of manufacture have dropped 20 percent, and we keep only one-seventh as much stock on hand. That has enabled us to reduce the cost of an engine by 10 percent in just three years."

#### **Trimming Management**

The information path has also been shortened. At the center of the shop an administrative unit, as close as possible to the action, controls flows, routes supplies, and manages and plans production. Before, those different departments were physically separated in the company. The manufacturing units are gradually becoming more autonomous. Besides doing their own defect inspection, the units manage production and monitor performance, tooling, costs, and turnaround times. Delegating these responsibilities to the machine operator sharply alters the hierarchical structure of the company. "The goal is to limit the number of middlemen," says Philippe Blin. "In production, there are only two floor managers and very few foremen left."

This cutback in management was only possible because Sulzer set up a training plan to teach employees both the

new work methods required by just-in-time and new skills, especially for machine operators. "Our success in implementing just-in-time was largely due to the receptive climate that had prevailed in the company for the last few years," admits Bertrand Martin, the CEO of Sulzer France-Diesel. "Back in 1984, we had initiated a program to make personnel more dynamic across the board. It was based on making information widely available. The employees' confidence and maximal commitment also enabled us to win markets and handle a 50-percent surge in overtime when we were implementing the just-in-time procedures."

The company also overhauled production processes. Engines used to be assembled entirely at the end of the line. Now partial assemblies are prepared in several preassembly units (rod assemblies, cam shafts, pistons, etc.) that are near the machining areas. Connecting-rod cotter ends, for instance, are manufactured in just a week instead of the more than one month needed before. The unit contains two machine tools (a vertical lathe center and a horizontal machining center, on pallet boards), a washing, deburring, and surface-treatment station, and a test (hydraulic trials) and preassembly station.

The pipework (water, oil, fuel) is also done in advance in a separate unit and not at the final assembly station as before. This makes for a time gain of 20 percent.

"Simply buying special assembly tooling and increasing the number of common tools can boost productivity substantially," says Xavier Craplet. "We gained a half hour per person per day by investing just 500 KF and reinstalling assembly benches."

Sulzer's implementation of just-in-time procedures has been of considerable help to the spare parts department. "If the customer calls us before 10 in the morning, the parts are on a plane by evening," Philippe Blin assures us. "Before, there was a turnaround time of a week."

#### **Machine Down Time Reduced Two Points**

Sulzer also took a fresh look at its methods for maintaining the machines. To shorten the time spent on maintenance and troubleshooting, emphasis was placed on prevention using systems to monitor the equipment (broach vibrations, heating of motors, and so on). A methods job was created in the service department to prepare the shops, and machine down time was cut two points to seven percent. The company initiated an Amdec study to pinpoint the weak spots of certain machines, especially those that work on three teams. Its push to make the machines more reliable was taken to the point of redesigning certain parts. The system for balancing the intertie rail of the portal milling machine, for instance, was modified because hydraulic problems cropped up from time to time.

Despite all these transformations, Sulzer Diesel France is not finished reorganizing. Its production information system, in particular, has not changed, and the existing

system is still running even though it has become too complicated to manage just in time.

"We will take care of that in our next round of investments," says Xavier Craplet. "We are also planning to move toward flexible production lines."

### **Italy: Advanced Robotics Laboratory, Projects Described**

93MI0056 Turin *MEDIA DUEMILA* in Italian Sep 92 pp 94-97

[Article by Nicoletta Castagni: "Where the Robotics of the 21st Century is Being Created"]

[Excerpt] In only three years, the advanced robotics laboratory of the St. Anna School at the University of Pisa has undergone a profound transformation, becoming a European center of excellence for robotics research. The reasons behind such a rapid and assertive development could already be seen in the work being carried out by 10 or so researchers headed by Paolo Dario on the perfection of tactile and visual sensors for robotic arms, remote-controlled operators, and robot cells.

The working group, which has gradually increased in number and branched out into other studies, has moved from the cloisters of the Convent of St. Anna into more spacious quarters in another of Pisa's historic sites next to a 14th century church, to give life to the ARTS lab. This acronym, stands for Advanced Robotics Technology and Systems Laboratory, and expresses the commitment—in the true spirit of university research—to achieving meaningful goals in a frontier discipline in which sensoriality itself is entrusted to the intelligence of machines.

This laboratory is a very special environment and unusual even in the research world. To spend a day there is to see it continually changing. It seems to be a workshop at times with the researchers busy with their memory boards, video cameras, and gadgets of every description. Then, at times, the theoretical and experimental aspect takes over. The components and little robots disappear from the worktables, and discussions and comparisons are carried out everywhere.

There are currently around 20 researchers in the ARTS lab and a further 20 counting the graduates, undergraduates, and researchers, who gravitate around the School of Engineering. The number is sufficient to carry out the numerous projects on technologies and devices, sub-systems, mobile robot systems, and to work on various other theoretical problems that are a pivotal point for the development of research in this sector.

Paolo Dario is always present coordinating the various working groups, and always ready to exploit the knowledge of his colleagues and students. He has his own personal philosophy about conducting research. Dario knows Japan well and greatly admires it. Above all, he

admires the wide scope and the spirit of collaboration that support major research projects. Very important developments are taking place in advanced robotics in the Land of the Rising Sun. In Japan, they are already talking about "biomechatronics," while Europe and the United States are still having difficulty perfecting mechatronic systems. Studies into cognitive science and physiology are very advanced and the little robots move like snakes or caterpillar-tracked vehicles. They are becoming increasingly smaller, almost invisible, and are opening the way to futuristic applications, while the micro-factory for the microelectronics of the 21st century is on its way to becoming a reality.

During the course of his frequent visits to Japan, Dario was able to learn how to work. According to Dario, the ARTS lab has two Japanese elements primarily, the spirit of interdisciplinary collaboration called harmony, and long-term planning. The interaction between different disciplines comes about without any individual discipline being considered the most important. When a machine is constructed in the West, it is always done by small groups and factions working separately and when the time comes for assembly, each wants to have the upper hand. This "prima donna" attitude can often jeopardize the success of a project.

In Japan, on the other hand, things start off more slowly, because each person must have an equal participation in the project. The objective is to develop a product that is everyone's project, even by sacrificing peaks of excellence. In fact, a project is not carried out to prove individual choices or the latest findings but to develop a truly functional product even if this sometimes means rejecting brilliant ideas because they do not suit the end purpose. Clashes lie at the basis of technological progress in the West, while in Japan, the high levels of synthesis and competition are left to other phases of the manufacturing cycle. Each individual is expected to give his utmost, while in European or American research centers it is the work of the exceptional individual that gains recognition.

According to the director of the ARTS lab, long-term planning is another winning card in the Japanese research system and one that the Pisa center definitely seeks to attain. Japan is still the only country to launch 10-year programs, such as those for the fifth generation, the NIPT [New Information Processing Technology Development Project], the super-calculator, and the microproject machine.

Some will give immediate results, while others are very long-term programs (a second artificial intelligence program is envisaged after the first 10-year program with investments totalling over 1 trillion lire), but effective innovation is the result of all these efforts. Meanwhile, basic research is disappearing everywhere in the West. Even Italy, according to Paolo Dario, is losing its foothold in some advanced areas such as robotics because we are not renewing or adapting to meet market requirements. [passage omitted]

It is not by chance that the only micromechanics laboratory in Italy was set up at the ARTS lab, where the approach to micro-manufacturing is not directed solely toward electronics and where innovative ideas are generated. The concept of not making distinctions between the practical and the theoretical aspects of research is clearly imprinted in all the center's work.

For Paolo Dario, the laboratory is a kind of flower, whose petals are separate and autonomous but at the same time firmly joined at the corolla. In the same way, each work group goes its own way by developing its own projects but never ceasing to make reference to the essence of the research activity. A wide range of theoretical and technological themes are involved in the development of components and systems for advanced robotics. The goal of these themes is to develop machines that are capable of interacting with the world by creating ever-more sophisticated sensors.

Sensors constitute the intelligence of a machine and the ARTS lab is trying to create various types. It was the St. Anna School center for engineering research that took the first steps in this sector where very little is done in Italy. "Artificial skin" was the first success for the researchers at Pisa, a synthetic fiber threaded with invisible sensors that allowed a robotic arm to recognize the shape of the objects it picked up. Three years ago, it was practically the only machine, together with its three connected computers, occupying the center's small laboratory.

Today, that arm has greatly evolved and now uses three types of sensors (tactile, thermal, and strength control, and to which will be added visual perception) and is able to recognize 18 different objects (aluminium, wood, soft and firm foam, etc.). It has been joined by other advanced robotic inventions with specific applications that Paolo Dario has entrusted to young and promising researchers who have greatly benefited from the ARTS lab activities.

Massimo Bergamasco is an expert in virtual reality, not in the more spectacular, much talked-about sense of the term, but in industrial applications. The ARTS lab is currently working on a project called "Glad in Art" under the ESPRIT [European Strategic Program for Research and Development in Information Technologies] program to develop a remote-controlled operator equipped with an exoskeleton. Bergamasco, who is in charge of this leading-edge "petal," describes the project as development of a man/machine interface with an actuated and sensorized glove that is capable of manipulating objects or machinery at a distance. The exoskeleton—here in a portable version for the first time—to which the glove is connected makes for an easy-to-use system.

Playing down the more fashionable side of this technology, Bergamasco defines the system as an advanced manipulation interface. The human operator puts on the exoskeleton, which is very compact and light, and the

glove through which he tells a remote robot how it should move. Through its sensors, the glove sends out impulses that direct the way in which contact is made between the robot and the object to be manipulated. The operator also receives feedback on the robot's actions, the "strength" feedback that is communicated to the operator through the actuators. This sophisticated and indispensable addition to the glove is currently available on one finger only, since it is an extremely complex procedure based on the concept of special actuators capable of reacting to thermal stimulation.

Solutions developed in collaboration with other European research centers would seem to be within reach, and though in some cases—such as the Scatis project—EC funding has been slow in coming, the work continues. The construction of a "medium complexity" robotic hand is also going ahead; a real telescience instrument. Developed for the Italian Space Agency, the hand is equipped with three fingers capable of carrying out a limited range of movements. As Bergamasco explained, this was a deliberate technological choice because the hand is intended for use in space to carry out scientific experiments, handle test tubes, and check complex apparatus. This means specific movements where the flexibility of movement of the human hand would be not only superfluous but even counterproductive.

The reproduction of the human hand is, however, a project on which the ARTS lab and the University of Bologna are working together. This anthropomorphic hand equipped with tendons is a system that is extremely complex to control. According to Bergamasco, it will be necessary to study the functions of the human hand all over again. Though they seem so simple to us, in robotic terms they are a highly articulated network of actuators working together like a very advanced supervision system.

The result of another joint effort, this time with the University of Genoa, is the artificial retina. This is simulated by a chip situated in a visual system with an actuated structure in a visual system with an actuated structure that permits the silicon eye to rotate vertically and horizontally. The eye has only two degrees of vision however, whereas man has three and also the ability to focus. But this is not the main shortcoming of the system which definitely represents an improvement but at the same time shows how much more must be done. According to Bergamasco, the speed of movement is still critical. The time taken to process images is too long and the movement of the actuators is slow and unreliable. However, research continues because projects in collaboration with DIST at the University of Genoa have proven to be the most constant and fruitful over the years. For some time DIST has also been conducting advanced studies on robot sensors. Another "petal" in the ARTS lab flower is its real-time control. Computer engineer Giorgio Bottazzo, demonstrates how a robotic arm can be controlled visually by using the concept that a robot can move in a nonstructured environment as a result of its sensorial intelligence.

The function of the telecamera that stands out above the black background is not to recognize objects but primarily to control the movements of the robotic arm. In order to simplify an extremely complex procedure, the researchers at Pisa have established various measurements, on the basis of which they can compare how the robot's vision compares with the image. After having visualized the known points once again, the system looks for the corresponding level and makes the necessary calculations. The robot is then able to follow the white ball at a preset distance by keeping the finger focused on its center. In this way the robot is capable of grasping a moving object and therefore of operating in real time.

Control through vision is particularly useful in agricultural applications such as using robots for fruit harvesting and milking. According to Bottazzo, however, development in this sector will involve using neural networks to create a nontraditional control system that is like the system developed by the ARTS lab but a self-organizing one.

Advanced robotics is considered by the ARTS lab to be a service technology and this is demonstrated by the many applications used in the field of medical assistance. Robots, as explained by electronics engineer and bioengineer Angelo Sabatini, can replace human beings in giving assistance to even the severely disabled. They can help the disabled in a variety of activities, such as eating, drinking, and grasping objects. The Pisa laboratory has developed a system in collaboration with the INAIL [National Institute for Insurance against Industrial Accidents] Artificial Limbs Center at Budrio that uses a robotic manipulator constructed in the Netherlands of which there are currently only 10 prototypes in the world.

To help ensure that concrete, functional solutions were achieved, the ARTS lab involved a group of handicapped people in its research. According to Sabatini who followed the difficult project step by step this kind of collaboration is very important because after finding a robotic arm such as the one made in the Netherlands, which can be also installed on wheelchairs, what really determines the efficiency of the system is the variety of interfaces that can be used.

The handicapped person needs to communicate with the robot that takes care of him by giving it orders and telling it what he needs. Unfortunately, in the most serious cases, and these are the majority, the person cannot use the keyboard connected to the Dutch prototype. The ARTS lab has therefore tried to find alternative methods of man-machine interaction. Among the many solutions is that of a pneumatic interface made by blowing with various degrees of strength depending on the patient's capacity for movement. This system uses a small tube into which the patients breathe. This simulates the pressure of a finger on the keyboard to choose the required function. Another interface consists of controls that respond to movements of the neck or even of the eyes in the case of totally disabled patients.

The ARTS lab is also working on a much more complex robotic system in collaboration with INAIL, says Sabatini, where mobility will depend not on the wheelchair but on the robot itself. It will be possible to use this mobile robot, which is still very bulky, anywhere: at home, in the hospital, and even in the workplace. The ability to move without being programmed naturally depends on a series of interacting sensors. Sabatini explains that they are experimenting on vision using an infrared telecamera that tells the robot where it is. A belt of ultrasonic transducers tells the robot what is happening around it, and identifies any unexpected obstacles to be avoided. Other sensors would allow movements to be estimated and then calibrated. [passage omitted]

Genovese suggests that the present state-of-the-art of robotics imposes simulation of instinct as the road to follow. The omniscient, anthropomorphic robot is still a long way off. While these micro-robots are not equipped with intelligence, they can still be used in many applications such as environmental monitoring, and the maintenance of infrastructures, etc.

At the ARTS lab, one of the main areas of research connected with the creation of mobile robots concerns agricultural robotics. Paolo Allotta, who has followed this work from the beginning has to admit that humans can still compete with robots in open areas. The robot can, however, prove to be very useful in the greenhouse for certain special crops and in biotechnology, but it is a market that still has to be created. It all comes down to the lack of research funding. So far, only the CNR [National Research Council] has launched a program for the construction of a tomato cultivation robot that will be equipped with two arms for pruning and tying. The first results are expected within the next two years.

Another promising sector, according to Allotta, is micro-propagation, a new technique that has grown quickly in the past few years. For now, most of the numerous producers work on a small scale and are not in a position to make heavy investments in technology. Over the next 20 years, however, the situation could change with all European propagation activities being concentrated in the hands of four or five large companies. Then a promising market would develop.

### **Italian Firm Develops Robot For Nuclear Boiler Inspection**

*93MI0082 Rome FINMECCANICA NOTIZIE  
in Italian 30 Sep 92*

[Text] The need to inspect the cavity walls of nuclear boilers has led to the development of a mobile robot called Portrans 1 (Porteur Ansaldo) that is able to carry a telecamera or tool to perform specific operations.

The robot was designed and developed by Ansaldo and consists of pneumatic equipment with three interacting elements. The upper and lower elements each have four clamping pistons that are designed to secure the robot to

the cavity wall with a walking movement. The sequence is ensured by a PLC [programmable logic controller] that permits the operator to control the movements of the robot by means of a four-way lever. Four pneumatic springs prevent the robot from falling and ensure that the pistons remain clamped to the walls, even in the absence of compressed air.

This mobile robot was developed for use in the Superphenix 1 boiler, but can be used whenever cavities, including curves or special areas, must be inspected.

## LASERS, SENSORS, OPTICS

### Germany: Max Planck Institutes Synthesize New Optical Polymers

93MI0039 Bonn *TECHNOLOGIE-NACHRICHTEN*  
MANAGEMENT-INFORMATIONEN in German  
18 Sep 92 pp 15-16

[Text] As part of a joint research project by Mainz chemists and physicists, polymers with high nonlinear-optical properties, such as those needed in photonics, are to be synthesized, and used in microengineering to create an integrated optical chip. This complex task, requiring continuous collaboration between researchers working in basic science and technology, is being undertaken by two institutes, the Max Planck Institute (MPI) of Polymer Research and the IMM [Institute of Microengineering GmbH], and is receiving 867,000 German marks [DM] in funding from the Volkswagen Foundation under its photonics program.

The MPI's chemists are synthesizing new kinds of macromolecules, the overriding aim, apart from mastering the many stages involved in preparing the substances, is to produce molecules of a design from which tailor-made physical properties may be expected.

A group of MPI physicists is studying both the linear and, particularly, the nonlinear optical properties of these materials that make the polymers of interest for photonically active components. The purpose of this research is to achieve a better understanding of the basic correlations between the molecular structures and nonlinear optical properties of materials. The intention is to derive "recipes" for optimizing plastics in terms of the desired application.

The IMM is attempting to use such plastics in small integrated optical functional elements. Conventional thin-film microstructuring processes are being used, as is LIGA [lithography, electroforming, second casting], which makes it possible to produce structures that are several hundred micrometers tall, but only a few micrometers wide, and are thus three-dimensional in comparison with "normal" microelectronic structures. The first stage consists in structuring a plastic by means of a special X-ray lithographic process, like exposing a

film. The resulting microstructures can then be galvanically recopied to form a metal "negative" that can be used as a microform insert for mass-producing plastic parts by injection molding.

This interaction between chemical synthesis, simulation using applied mathematics, and microstructuring experiments is intended to culminate, at the end of the project, in a simple, perhaps nickel-sized integrated optical chip. The intention is to demonstrate that highly sophisticated plastics can be combined with new, targeted micromanufacturing processes in new ways, thus contributing to progress in communications engineering.

Further information is available from Professor Dr. W. Ehrfeld, Institute of Microengineering GmbH, Ackermannweg 10, 6500 Mainz, tel. (06131) 379-161, or Professor Dr. K. Mullen and Dr. C. Bubeck, Max Planck Institute of Polymer Research, Ackermannweg 10, 6500 Mainz, tel. (06131) 379-150.

### Norwegian Company Develops Buoy-Placed Algae Sensor

93WS0094W Stockholm *NEW SCANDINAVIAN*  
*TECHNOLOGY* in English No 3, 1992 p 6

[Article: "Algae Warner: Buoy-Placed Sensors an Effective Weapon"]

[Text] Measurement of light changes, colour identification and signals via satellite to land could become an effective weapon in the struggle to deal with the algae that affect and, in many cases, ruin the marine environment. The Norwegian company Oceanor A/S, based in Trondheim, has co-operated with scientists at the Trondheim Biological Station on development of a buoy-placed sensor based specifically on how light changes and on colour identification, and with a possibility to identify the 33 most harmful species of algae that risk affecting the global marine environment if their growth is not detected and controlled.

These algae sensors, the scientists believe, could be placed 2-3 metres below the surface of the sea on floating buoys along the Norwegian/Swedish coast together with 15-20 other sensors which will record other conditions and substances in the sea. The measurement results are transmitted to analysis stations on land, where the different results/recordings are interpreted and combined. Four buoys with algae sensors have been in operation in the Skagerak and on the coast of Norway for the last three years and, since December 1991, Oceanor has been able to register occurrences of algae in the Siam Bay from its buoys which are stationed between the Bay of Bangkok and Cambodia.

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## MICROELECTRONICS

### SGS-Thomson, Siemens Sign Microcontroller Accord

93MI0015 Milan *ITALIA OGGI* in Italian 20 Sep 92  
p 12

[Article by Gian Carla Perego: "Cooperation between SGS-Thomson and Siemens"]

[Text] SGS-Thomson Microelectronics and Siemens AG are strengthening their alliance. The two giants, both leading European semiconductor manufacturers, have announced that they intend to intensify joint efforts in the area of microcontrollers and primarily the family of 16-bit Sab80C166 microcontrollers. These microcontrollers with a Siemens architecture will be equipped with a Flash EPROM [erasable-programmable read-only memory] developed by SGS-Thomson.

Controllers having a Flash EPROM memory (electronic components that control certain functions such as automobile ignition) are used in several applications such as automobile electronics and computer products. Their use enables programs to be modified even in the preproduction stage and to be customized during mass production. In this way, SGS-Thomson ensure the specific needs of customers can be satisfied more effectively.

In addition to its current license for the manufacture of Sab80C166 microcontrollers, SGS-Thomson also produces the Sab80C167, an upgraded version of the Sab80C166 in the same ST10 family. The Italian-French group also develops made-to-order products or standard products included in its product range and based on the central processing unit of the 80C166/167 microcontrollers. For the two microelectronics companies, the accord represents an opportunity to use the 16-bit microcontrollers to develop a wider product range with more applications.

The SGS-Thomson microelectronics group with its 17,000 employees, eight R&D centers, and 17 manufacturing plants worldwide is an international manufacturer of semiconducting devices. It was established in 1987 following the merger of SGS-Microelectronics and the French company Thomson Semiconducteurs. All the group companies are owned by SGS-Thomson Microelectronics NV, 90 percent of which is equally controlled by two partners: IRI [Institute for the Reconstruction of Industry]/Fintermica in Italy and Thomson CSF in France. In 1991, SGS-Thomson, with registered offices in Agrate Brianza (Milan) and Gentilly (Paris), recorded revenues amounting to \$1.5 billion (approximately 1.84 trillion lire), placing it second in Europe. The Munich-based electronics colossus Siemens boasts revenues amounting to \$45.6 billion (almost 56 trillion lire) and has over 400,000 employees. In 1991 its profits totalled \$1.1 billion (approximately 1.35 trillion lire).

## NUCLEAR R&D

### France, Germany To Build Nuclear Plant

93WS0041B Paris *L'USINE NOUVELLE* in French  
1 Oct 92 pp 48-50

[Article by Jean-Pierre Gaudard: "A Franco-German Model for a Nuclear Plant"; first paragraph is *L'USINE NOUVELLE* introduction]

[Text] On either side of the Rhine, Electricity of France (EDF) and four German accomplices are busy constructing Europe. Framatome and Siemens have hopped on the bandwagon, whose goal is to improve the safety, environmental friendliness, and economic efficiency of nuclear plants.

It is called the EPR, or European Pressurized Reactor. The EPR is the Franco-German nuclear plant of the future, and has been discreetly under study since the beginning of the year. Construction of the first plant based on the model may get underway by 1998.

The main promoters of the project are the power companies: EDF in France, and a quartet led by PreussenElektra and including RWE, Bayernwerk, and Badenwerk in Germany. These plant operators, together with reactor builders Framatome and Siemens, have decided to team up to create a European atomic industry. Such an alliance is a watershed for the nuclear industry, which has thus far remained confined within national boundaries.

During the first decade of the next millenium, the EPR could be to the atom what Airbus is to aeronautics or Ariane to space. The project's principal asset is a good understanding among its partners—which does not rule out conflicts of interest between EDF and the main German power companies. Over the last few years, power suppliers have expanded their relations beyond technical cooperation to include joint strategic planning.

One example is the future involvement of EDF in work to modernize the electrical power systems of the eastern lander. The collaboration between EDF and PreussenElektra, which owns the greatest number of nuclear plants in Germany and belongs to the Veba group, seems especially productive. Veba is seriously considering acquiring a capital stake in COGEMA [General Nuclear Material Company].

Though barely in the pipeline, the EPR reactor has already snuffed out one choice victim: Framatome-Siemens's "joint product." This creation was supposed to result from the controversial 1989 alliance between the French boilermaker and the German giant, which called for the two to create a joint subsidiary dubbed Nuclear Power International (NPI). The decision to shelve the joint product destroys much of NPI's strategic value, and dispels the specter, raised by many, of a Framatome reduced to the status of a Siemens "satellite."



Neither Alcatel-Alsthom, which holds shares in Jean-Claude Leny's group, nor EDF were thrilled with the Framatome-Siemens match. The French power company had no intention of becoming the captive customer of a nuclear reactor destined for export. Moreover, EDF had its own strategy for technology development with the Rep 2000 project and, more immediately, the N4 plants. The most striking innovation of the N4s is their new inspection/control system. Yet another Franco-German pair—Sema for the software and Hartmann & Braun (Mannesmann group) for the automats—designed and manufactured it. The German power companies, which had awarded Siemens the research contracts for their own program of improvement, dubbed Convoy, did not find the situation much more to their liking. Some say that Siemens did not listen to its customers' opinions as much as it should have.

### Zeroing the Dials

It was at the beginning of the year that everyone decided to zero the dials and halt all the separate projects. They included EDF's N4+, the presumed successor of the present N4 phases, the German power companies' Convoy, and Framatome-Siemens's joint NPI product. "Siemens realized that the joint product, which was meant to be sold in markets other than France and Germany, was not viable, and seems happy to restore NPI's long-lost credibility," says a source who follows the matter closely.

For the EPR which French and German power companies and manufacturers will build together has one advantage from the outset: EDF is certain to buy it. The public company says its years of surplus electric power are behind it, and believes it is now in a position to order a new nuclear plant every 12 or 18 months.

All the partners are determined to move quickly. Since March, they have held a hundred in-depth technical meetings and are operating on a tight timetable. The schedule calls for a preproject to be presented to French and German safety officials by the spring of 1993, and the companies hope to have an opinion on it by late 1993 or early 1994. A full-scale, detailed preproject may be submitted by 1995, and if everything goes well, construction of the first Franco-German plant model will begin around 1998.

An alliance of the two countries' power suppliers and manufacturers should carry considerable weight in an increasingly international nuclear market. It is true that orders for plants are still rare. But specialists expect things to get brighter early in the next century. The signal may come from the United States, which has a pressing need to revamp its supply of power plants, or from East European countries if their economic situation improves. The American firms Westinghouse and General Electric, Europe's ABB (which took over Combustion Engineering in the States), and Japan's Hitachi, Mitsubishi, and Toshiba are each preparing their reactor of the future with those markets in mind. The gold ring

will go to whoever is the most convincing, economically and in terms of safety. The EPR will give Europeans the opportunity to present industrial-scale plants, but ulterior political motives are just as important. The nuclear consensus is crumbling, and EDF can no longer afford the luxury of remaining isolated in Europe. "Having the approval of both the French DSIN [Nuclear Installation Safety Directorate] and German safety authorities is like having the franc backed by the Bundesbank," comments an official half-jokingly. German power companies—who are and will long remain unable to build new nuclear plants—want modern, advanced reactors that have proven their worth. The EPR will be a water-pressurized reactor, like those the EDF has been operating for over 15 years. Plant operators insist on the need not to venture into unknown territory. "It is crucial that we continue along the lines of what has been done before, in order to benefit from the 'return on experience' provided by existing installations," explains a specialist.

The EPR program seeks to improve the safety, environmental friendliness, and economic efficiency of plants. Accordingly, work is being done to beef up "deep protection" of nuclear installations. That means more effective confinement of the primary shell and circuit, among other things.

Technicians are also pondering ways to further reduce the likelihood of hypothetical, but very serious, accidents such as reactor fusion—the so-called "Chinese syndrome." One solution they are considering is redesigning the lower part of the core to extend it. Studies of the problem have been contracted out to the Atomic Energy Commission (CEA). Plans also call for ways to simplify operation and maintenance, to limit the risks of human error. Operator experience is invaluable here for determining critical points. Along the same lines, working groups are examining the problems of control and inspection of the future plant, which will probably closely resemble the B1 and B2 model being built in Chooz. The latter are EDF's first N4-generation reactors.

Finally, various studies on nuclear fuel reflect economic and environmental concerns. Operators would like to produce 50,000 megawatts a day per ton of fuel, instead of the 42,000 to 45,000 now generated by EDF plants. This has the dual advantage of reducing costs and the volume of uranium handled. The new reactor will also have to be designed to burn plutonium in optimal fashion, in the form of MOX fuel.

The balance of power in this team effort by operators and manufacturers to design the nuclear plant of the year 2000 has tilted in favor of the power companies. That was inevitable, since Framatome and Siemens have no other potential customers. Moreover, because the EPR is a "progressive" reactor, which follows in the footsteps of those which preceded it, research work is based largely on the operations experience of the current group of plants. That is the bailiwick of the power companies.



Logically, then, French and German collaboration on the future plant should strengthen the EDF's hand in France's nuclear industry, which has entered a remodeling phase these last few months. The cleverly-drawn boundary lines of the early seventies are collapsing.

The CEA's missions are being redefined (see boxed material) and the agency has lost any real oversight over manufacturers. The new president of CEA Industrie, Jean-Claude Hirel, will have no more real authority over his two main subsidiaries COGEMA and Framatome than did his predecessor. Another player, Pechiney, has recently gone by the boards. The group presided by Jean Gandois was forced to sell its nuclear shares to COGEMA and Framatome last June, under heavy pressure.

The decision to shelve the joint Framatome-Siemens product is a setback for the independence strategy of Jean-Claude Leny, the French nuclear boilermaker's feisty president. With the massive arrival of the power companies, Franco-German cooperation seems much more balanced than it did when Framatome and Siemens were facing off alone. But Framatome's room to maneuver vis-a-vis its French partners has been sharply curtailed.

This is especially true now that there is widespread talk of increasing EDF's investment in Framatome, which is presently limited to 9.8 percent. When CEA Industrie expands its involvement in electronic chips, it may sell a portion of the 36.18-percent interest it holds in Framatome to EDF. EDF's management has already publicly approved the move, which would enable the public company to shore up its position as a real player in the nuclear industry, along with Alcatel-Alsthom. Alcatel-Alsthom is Framatome's other big shareholder, and holds 44 percent of its capital.

#### **Boxed Material: Reorganization In the Air at the CEA**

Has the Atomic Energy Commission begun its cultural revolution? The CEA's announcement that it will move its headquarters out of Federation Street and keep only 150 to 200 people in its Paris main office is an early warning of an inevitable change.

Its administrators, impelled by budget restrictions and acerbic criticism from some government circles, have apparently decided to restore some order to the way they manage the research organization.

Philippe Rouvillois received his mission letter cosigned by the ministers of defense, research, and industry a few days ago. Mr. Rouvillois was reappointed as CEA administrator general just before the start of the summer vacation season.

But the key player in the reorganization will be Yannick d'Escatha, who replaced Guy Paillotin as assistant administrator general. Unlike his predecessor, Philippe Rouvillois's new right-hand man will enjoy substantial operating powers. It will be his job to save money, promote communication among the different research teams, and establish priorities: in a word, to impose himself as the CEA's real administrator at the expense of the organization's various departments, which now function as so many bastions.

The CEA is going to shift its focus back to basic nuclear research. Although the organization expects to retain its ties with manufacturers, its researchers will have to keep their distance. They will not, for instance, do as much technical monitoring in nuclear installations, especially in COGEMA plants. Research programs will also be selected to meet Philippe Rouvillois's three priorities, which are new-generation reactors, laser enrichment of uranium, and end-of-cycle management (waste and dismantling, etc.). The administrator general describes the three areas as "the real Achilles heel of the nuclear industry." Military work is being severely curtailed: Plutonium production was halted two years ago, and the number of weapons manufactured is dropping. To preserve its [research] potential, the Directorate of Military Applications signed a protocol with the Defense Ministry in July authorizing it to spend about 10 percent of its resources on studies that are not specifically nuclear.

In the realm of basic physical and biological research and non-nuclear studies (electronics, materials, and so on), the CEA is moving toward expanded collaboration with other French or foreign organizations. Philippe Rouvillois has come out in favor of "a comprehensive reassessment of the goals and resources of France's heavy physics capabilities."

#### **Table Information: A Shakeup Is Around the Corner**

The figures below demonstrate the CEA's conservative nature. In 10 years it has hardly varied the distribution of its research budgets. The only notable change is the amount invested in protection, safety, and cleanup.

1. Fuel cycle: 18 percent in 1982; 19.1 percent in 1992.
2. Nuclear safety and protection: 11.9 percent in 1982; 14.6 percent in 1992.
3. Nuclear reactors: 23.3 percent in 1982; 16.1 percent in 1992, with an additional 3.6 percent allocated to cleanup (waste and dismantling) of the reactors.
4. Matter and life sciences: 26.9 in 1982; 26.3 in 1992.
5. Advanced technologies: 15.5 percent in 1982; 16.2 percent in 1992.
6. Other programs: 4.3 percent in 1982; 4.1 percent in 1992.

**France and Germany, the Two Heavyweights****Number and Distribution of Nuclear Plants in Europe**

	Installed Capacity	Number of Plants
France	55,370	56
Germany	24,430	26
Sweden	9,817	12
Spain	7,067	9
Belgium	5,500	7
Switzerland	2,952	5

**Boxed Material: How France and Germany Differ in Nuclear Safety Applications**

Although French and German notions of nuclear safety are close, the way they are applied—by the DSIN in France and the BMU in Germany—vary. Here are a few examples:

- The confinement shell is made of concrete in France and metal in Germany;
- The primary circuit pipes are made of stainless steel-lined black steel in France and of totally stainless steel in Germany;
- The confinement shell's sprinkler system has two connected pathways in France and four separate ones in Germany;
- The design of the secondary-circuit valves are different in the two countries;
- The pool for storing fuel elements is located outside the reactor building in France, and inside the reactor in Germany.

**SUPERCONDUCTIVITY****Riesenhuber on Superconductor Research, Applications**

93WS0066A Duesseldorf *HANDELSBLATT* in German  
22 Oct 92 p 6

**["Applications Success with Superconductors"]**

[Text] *hjs BONN*—Just six years after the discovery of the high-temperature superconductor, the first clear applications successes can already be recorded. German Federal Minister of Research and Technology Heinz Riesenhuber confirmed this yesterday in Bonn and commented: "Even the experts were surprised by the rapid development."

The technology is supported by the Ministry of Research and Technology under the "Superconductor Support Program." On the basis of the present state of affairs, the program will have allocated a total of about 320 million German marks [DM] to the project in the period 1989-1995.

Riesenhuber gave a few examples of the first successful applications:

- **Power Engineering:** Superconductor technologies save raw materials right from the initial generation of power, through its transport and transformation, to its final storage. At the same time it makes more effective use of power because of improved efficiency. A superconducting generator is already being tested. To be sure, it will be another 10 to 15 years before it is widely used.
- **Waste Management.** In this field the superconductor is already contributing to the sorting of waste materials. On occasion, superconducting magnetic separators are already being used in ore dressing and kaolin purification.
- **Climatology:** In the field of communications technologies, superconductors with superconducting antennas, filters and spectrometers facilitate more effective remote investigations, resulting in better harvest forecasts and environmental monitoring. Above all, so-called superconducting bolometers are able to ascertain forest damage more precisely than previously.
- **Traffic Control:** In satellite-supported guidance and position data, power-saving effects are achieved by means of superconducting high-frequency engineering techniques.

According to Riesenhuber, most research in superconductors will be in the form of joint research projects, i.e., major research facilities, universities, institutes, and private businesses will all cooperate—based on the principle of the division of labor—in the solution of complex undertakings. Riesenhuber notes that in 1991 industry invested more than DM21 million in this research. Besides the universities, institutes of the Fraunhofer Society, the Max Planck Society, and the so-called Blue List are participating.

In late September, in Potsdam, the Ministry of Research and Technology conducted a "Status Seminar," in which the state of German research activities in superconductors was accessed. In this regard, Riesenhuber stressed the successful integration of work groups from the former GDR in this research.

**TELECOMMUNICATIONS****France's Zuccarelli on HDTV, D2-MAC, Cable, Satellites**

93WS0015 Paris *MESSAGES* in French Sep 92  
pp 26-27

[Interview with Emile Zuccarelli, by Pierre Salanne; place and date not given: "Emile Zuccarelli: 'More Pictures, More Europe'"—first paragraph is *MESSAGES* introduction]

[Text] Cable, satellite, HDTV [high-definition television], D2-MAC [multiplex analog component], Emile Zuccarelli reviews the "new picture generation" and comments on the agreement he just signed on behalf of

the government concerning the use of the Telecom 2A satellite. Focus: the Europe of pictures, and Europe plain and simple.

**[Salanne]** You inherited two difficult cases: cable and satellite broadcasting of television programs. What kind of future do you think they have in France?

**[Zuccarelli]** Cable, as well as direct reception via satellite, are modern ways of receiving TV channels. I am convinced that they will become very widespread during the next few years. This, for two main reasons: they are the only ways of giving TV viewers both more programs (15 to 30 channels), which means more choice, and the television of tomorrow associating wide-screen 16/9-format broadcasting and the D2-MAC standard. This new picture generation, combining stereo sound, a large cinema-format screen, and better quality, is a springboard to high-definition TV.

Therefore, as soon as I assumed my present functions, I decided to try and provide real impetus for cable and satellite, which are not yet as well known as they should be. And I wanted to do this so as to complement radio-relay broadcasting, and to meet reception constraints in both densely populated and rural areas as well as the increasing demand for quality service and program diversification.

**[Salanne]** A few months ago, at a ministers council, you introduced a series of measures to boost cable television. Have these measures started to yield results?

**[Zuccarelli]** The cable promotion plan is based on three arguments: simplicity for the subscriber, improved program offering, and better quality/price ratio. It is now being implemented: cable operators using Cable Plan sites have signed agreements with France Telecom that made it possible, already last spring, to lower subscription rates by an average of 15 percent, and to offer a product better suited to consumers' needs. The law that makes it easier to install cables in multiple-dwelling buildings was passed last June: it will make it possible to bring cable to most people, especially in subsidized housing projects. Finally, the cable decree, which constitutes the third facet of this plan, was just published: It allows cable operators to broadcast more movies, and it relaxes regulations concerning cable channels.

Obviously, you can't measure the success of cable television in three months: it took 30 years in the United States. But the first positive signs are beginning to appear: The psychological threshold of the millionth subscriber should be reached within the next few weeks, and cable operators have recovered their dynamism and their ambition, as can be seen from the promotion campaign they just launched. I am sure that the joint efforts of cable operators, France Telecom, and the local communities concerned will succeed. But cable television does not aim to cover the entire territory all on its own. Therefore, it must be backed by satellite television, which is its natural complement.

**[Salanne]** You have also just signed an agreement on the use of the Telecom 2A satellite.

**[Zuccarelli]** Telecom 2A, which France Telecom launched into orbit last spring, offers 11 channels to broadcast television programs. Enough to provide true impetus to direct satellite reception in France. I wanted Telecom 2A to meet two complementary objectives. First, to bring new channels to as many people as possible, especially in cable-less areas. Second, to act as a spearhead in promoting the new 16/9 format associated with the D2-MAC standard.

A few days ago, I signed an agreement that fully meets these two objectives: next to seven SECAM [sequential memory color system] channels—a standard now restricted to cable television—Telecom 2A will also broadcast four channels in D2-MAC 16/9. Starting next November, three channels—France 2, Canal Plus, and Cine-Cinema—will make an unprecedented 16/9 programming effort, reaching 20 hours per day by mid-93. A new channel entirely devoted to the 16/9 format is also under consideration.

Canal Plus will broadcast at least 80 percent of its movies in the new format, as well as its major sports events. Similarly, France 2—after broadcasting about 1,000 hours of 16/9 pictures in 1992, mostly sports—will further intensify its efforts and also broadcast most of its movies in 16/9 format. Thus, Telecom 2A will provide manufacturers with the attractive 16/9 programs that were lacking until now, and this will bring out the advantages of their large-screen TV sets.

I negotiated the agreement with the viewers' interest in mind. For instance, viewers will not pay more for 16/9 channels than for their SECAM versions. Similarly, if we reach an agreement with manufacturers, viewers will be able to rent D2-MAC satellite tuners instead of having to invest in the equipment. Starting in November, we are definitely going to enter the 16/9 era.

**[Salanne]** Will this agreement be enough to save D2-MAC?

**[Zuccarelli]** Better still, this agreement will ensure the future of D2-MAC. D2-MAC is the only standard that will make it possible to broadcast the new 16/9 format that will be in current use in five years from now. All that was still needed were pictures to show the new TV sets to advantage. Starting next November, pictures will arrive via cable and satellite, thus enabling France to lead the race.

**[Salanne]** What is Europe's contribution to HDTV?

**[Zuccarelli]** HDTV, as we are preparing it, cannot exist without Europe. Like all major technological projects, the European dimension is essential in terms of investment, research, and development.

HDTV originated in France, but it was thanks to manufacturers' cooperation under the European EUREKA research program that Europe was able to develop an

advanced technology and enable our manufacturers to take the lead ahead of their American and Japanese competitors.

In the EEC, each country takes initiatives, and France holds a good rank. But each country can also feed on other member countries' brains and projects to further enhance its own capabilities.

[Salanne] European HDTV is on its way. But Europe also concerns the sectors that you are supervising.

[Zuccarelli] Of course. Europe offers development opportunities in all our sectors, the audiovisual sector as well as telecommunications and the Post. The Post and French Telecom are endowed with a legal status that gives them the means they need to adjust to changes in their environment, expand their activities, and strengthen at EC level their image of efficient and enterprising public services. More generally, I would like to recall that Europe is a grassroots dynamic movement. The Europe of technologies, economic Europe is already on its way. With the Maastricht treaty, Europe will progressively acquire the legal—and social—framework it needs to continue its development harmoniously.

In our sectors, as in many others, France has nothing to fear from Europe. The value of its men and women, the quality of its technologies, its central geographic position, and the influence of its culture guarantee it a prominent place within Europe.

[Salanne] Now that social reform at the Post and at France Telecom has completed two major stages, some wonder about the impact that the Maastricht treaty will have on already agreed-on social benefits.

[Zuccarelli] There is nothing to fear from the Maastricht treaty. On the contrary, it provides for appreciable progress in the social sector: safety at the workplace, workers' health, working conditions. It does not affect remunerations, nor the right to unionize or to strike. And it provides that each member state must retain its social standards. Besides, I would recall that the European Union Confederation approved the treaty. I would also recall that one of the best social protection systems in the world, ours, will serve as a reference for other member states.

As for the Post's and France Telecom's personnel, it is quite out of the question that the Maastricht treaty should pose the slightest threat to their status. They are government employees, and will remain so because that is a matter for France alone to decide.

Europe cannot remain essentially a trade group, nonexistent as far as currency is concerned, and politically insignificant. The Maastricht treaty aims to correct these faults of today's Europe. This is why we must resolutely head toward Europe. It is a long road, but it is our future.

## Germany: Digital TV Awaits Development of Signal Processing Chips

93MI0037 Bonn DIE WELT in German 8 Oct 92 p 9

[Article by Walter Schild: Tomorrow's TV Will Be Digital]

[Text] HD-MAC, the analog European high-definition TV broadcasting standard developed with a great deal of work and at considerable public expense, seems well on the way to becoming an expensive flop. For instance, experts were disappointed by the quality of the recent test satellite transmissions from the Barcelona Olympics.

There is an obvious alternative, however: digital transmission of HDTV [high-definition television] signals. Munich's Institute of Radio Engineering [IRT] has just demonstrated for the first time that digital signal transmission of an HDTV magnetic tape recording via a Copernicus satellite transponder is now possible.

The institute set up a direct visual comparison of the original recording and the satellite transmission: The specialist audience was unanimous in finding no visible difference from the original.

Using a new coding procedure, digital TV signals from, for instance, the planned high-output Europsat TV satellite could be received by dish antennae of no more than 90 centimeters' diameter; wired broadcasting would also be possible.

The catch lies in the sophisticated new chips that have to be developed specially for digital signal processing: Siemens's engineers do not expect them to be obtainable before the turn of the century. Given sufficient demand, however, their development could probably be speeded up. Analog HD-MAC broadcasting, which is clearly inferior, would then have just five years to establish itself. As IRT director Heinrich Wilkens puts it: "HD-MAC's time is running out." Skeptics would say it has already run out.

## Eurafrica Submarine Cable Activated

93WS0057D Chichester INTERNATIONAL  
TELECOMMUNICATIONS INTELLIGENCE  
in English 7 Sep 92 p 1

[Text] The Eurafrica fibre-optic submarine cable linking France, Portugal, Morocco and the island of Madeira entered service on August 19, 1992.

The new cable, which is 3,280 km long, was installed by the French company Submarcom. Depending on the segment, it contains one or two pairs of fibre-optic cables and is equipped with S560 systems, utilising 1.5 micron laser technology, which allows transmission of information at 565Mbit/s per fibre pair.

The cable's landing points are located at St. Hilaire de Riez (France), Sesimbra (Portugal), Casablanca (Morocco) and Funchal (Madeira). In addition to adding

capacity for increased digitalisation of the telecommunications networks linking the three countries, the system will also handle digital traffic via Madeira to South Africa via the SAT-2 system (due to enter service in 1993) and to Central and South America via the Columbus 2 system (scheduled for service in 1994). Digital extensions will also transmit through St. Hilaire de Riez to serve the rest of Europe via the French domestic network, and to North America via the TAT-9 transatlantic cable.

The Eurafrica cable represented an investment of approximately US\$150 million by the 21 telecommunications operators which own the system. The two largest investors are Portugal's Companhia Portuguesa Radio Marconi with a 30 percent shareholding, and France Telecom's Franca Cables et Radio subsidiary with a 28 percent stake.

#### **Sweden: Ericsson Launches New Telecom Products**

*93WS0073E Chichester EUROPEAN  
TELECOMMUNICATIONS INTELLIGENCE  
in English 19 Oct 92 pp 4-5*

[Article: "Sweden: Ericsson Launches New Products at Europa Telecom"]

[Text] Attending the Europa Telecom '92 exhibition in Hungary last week, Ericsson launched a modular radio access system that offers an alternative method of connecting subscribers to new or existing local networks, using radio links instead of copper wires.

Using a radio air interface based on the Nordic Mobile Telephony (NMT) standard, RAS 1000 interfaces directly with local exchange equipment to provide fixed subscriber connections over radio links via a radio base station.

To the user there is no difference between using a telephone connected by radio and one connected by cable. Standard telephone equipment is plugged into a socket on the wall in the usual way, and a radio transceiver takes the place of the ordinary cable junction box.

The local exchange also treats a subscriber connected over radio in exactly the same way as one connected by cable. All signalling and translation tasks required to set up calls over the radio link are handled by the RAS 1000 itself.

With RAS 1000, new connections are made simply by installing a user terminal and switch interface. Reconfiguration of the subscriber network is also greatly simplified. In metropolitan areas, for example, the system could be used to provide extra capacity on demand for business users.

Ericsson is offering RAS 1000 as a modular package. Radio access capacity may be added to the local exchange in 30-channel stages. A 30-channel connection

would provide enough capacity for around 300 subscribers, while a 90-channel system could serve up to 1,200 subscribers, says Ericsson. No modification of the local exchange is required.

The system comprises: a switching interface module (SIM), which interfaces with the local exchange and performs radio channel switching; a translator module, which controls base station and performs signalling functions; a radio base station; and user terminals. A PCM multiplexer is also required between the SIM and the local exchange if the exchange is analogue.

RAS 1000 may be operated in the 380-500 MHz range or the 800-1000 MHz range. There are also plans for the introduction of a version of the system for use in TACS-based networks to provide 450 MHz fixed radio access within existing cellular infrastructure.

#### **Launches New Cellular Mobile System for NMT 450 MHz...**

Ericsson also launched a new version of its NMT 450 MHz cellular mobile network, called NMT 450I. New features in NMT 450I include: Improved call completion and quality monitoring facilities; subscriber identity security (SIS) caller authentication; smaller, higher-capacity radio base stations, and improved speech quality through the use of companders.

NMT 450I is based around Ericsson's AXE switch for mobile telephone networks. The MSC software will be upgraded to include subscriber authentication and priority subscriber facilities, improved speech quality and call capacity for small-cell networks, new signal strength supervision procedures, new umbrella cell concept, a traffic levelling function, and handover request channels. The MSCs are able to handle both NMT 450I and earlier NMT 450 subscriber categories.

A new radio base station for NMT 450I, called RS4001, has been introduced by Radiosystem Sweden AB. Its main features include double channel capacity over existing systems (increased from eight to 18 channels per transceiver), autotuned combiners, the use of companders and automatic control and adjustment of transmitter power. In addition, many maintenance tasks can be carried out remotely via a modem link, or locally using menu-based software on a industry-standard PC.

#### **UK Firm To Market World's First Hybrid Cordless Phone**

*93WS0073F Chichester INTERNATIONAL  
TELECOMMUNICATIONS INTELLIGENCE  
in English 19 Oct 92 p 5*

[Article: "United Kingdom: GPT CSL Announces World's First Hybrid Cordless Phone System"]

[Text] GPT Communication Systems Limited (CSL), the jointly-owned Siemens/GPT UK marketing and services company, has announced the commercial launch of what

it believes is the world's first cordless hybrid CT-2-based telephone system specifically designed for small to medium-sized businesses.

The ISDX 100 supports up to 100 fully-featured CT-2 cordless handsets in addition to a combination of feature phones and low-cost standard phones. Incoming calls can be dealt with by either a single operator or taken by several pre-assigned staff, while dedicated lines can, for example, allow service calls to pass directly into a service department. In addition, a sales department may be given access to the majority of outside lines and keysets while accounts could be configured to have limited line access and ordinary telephones. Flexible secretary/manager working can be accommodated and it is also possible for a single secretary to serve several managers.

The range of management features offered by the system include call logging and five levels of call barring from full international access to only '999' calls. For the user, it offers speed dial of 120 20-digit numbers and will support conference calls with up to four individuals. Feature phones provide text messaging to inform internal callers of a user's whereabouts, while hands-free answer-back saves a user from picking up the handset to answer either their or a colleague's internal calls. Paging a particular work group to locate individuals is also permitted through the feature phone's internal speaker.

#### **Denmark/Russia Submarine Fiber-Optic Cable System Completed**

*93WS0073G Chichester INTERNATIONAL TELECOMMUNICATIONS INTELLIGENCE in English 26 Oct 92 p 1*

[Article: "Denmark/Russia: Submarine Cable Link Completed"]

[Text] On October 9, Northern Telecom's STC Submarine Systems subsidiary completed the installation of the Denmark-Russia submarine optical fibre cable system. The system represents the first digital cable link to Russia and the first direct cable between Denmark and Russia. The project was carried out by Telecom Denmark, and GN Great Northern Telegraph Company in co-operation with A/O Intertelecom, Russia's international telecoms operator.

The 1,210 km-long cable has been ploughed approximately 60cm into the seabed of the Baltic between Kingisepp near St. Petersburg in Russia and Karlslunde, near Copenhagen, Denmark. Further details of the project were published in ITI issues 308 and 330.

The link is scheduled to enter operation on March 1, 1993, when additional links from Kingisepp to St. Petersburg (124km) and to Moscow (810km) have been established. These links will consist of 140 Mbit/s microwave systems supplied by NEC of Japan under a turnkey contract awarded to Sumitomo Corporation. Telecom Denmark and GN Great Nordic also carry the overall responsibility for the establishment of this part of the

project. Altogether, the project has required investments totalling Dkr580 million. In February of this year, more than 20 other PTOs from around the world purchased capacity on the system which will be used for international voice, data and possibly video transmissions between the CIS and the rest of the world, with retransmission via Telecom Denmark's station in Albertslund near Copenhagen.

The two Danish partners and intertelecom are also involved in a project to lay a submarine cable between Russia, Japan and Korea (R-J-K), and a land-based fibre-optic link between Nakhodka and Khabarovsk in eastern Russia. Prequalification applications were recently called to tender for these two projects (see ITI issues 355 & 359).

Telecom Denmark said that the ultimate plan is for the Denmark-Russia and the R-J-K cables to be connected via land-based cables crossing the Russian continent.

#### **Siemens To Supply Norwegian GSM Network Infrastructure**

*93WS0094B London MOBILE EUROPE in English Sep 92 p 14*

[Article: "Siemens To Supply Norwegian GSM Network Infrastructure"]

[Text] NETCOM A/S, Norway's private mobile communications operator, has awarded a DM90 million (ECU44.2 million) contract to Siemens AG to design, install and commission its GSM cellular network.

The new network will be operational by the end of 1994, and will provide coverage for almost 90 percent of the country. Initially 100 GSM transmitters will be installed in the 342,303 km<sup>2</sup> country.

Erwin Fellner, a spokesman for Siemens AG's public communications networks division, says that Siemens is delivering a full turnkey system to Netcom, which includes switches, transmission and operation centres, the construction and erection of masts, radio and terrestrial network planning, technical assistance and project management.

"With GSM technology in the 900MHz and 1.8GHz band, we in Europe now have a high-capacity, low-cost uniform technology for the first time, which is able to meet market demand over a long period," said Dr Hans Baur, executive vice-president of Siemens AG. "The design of this system, with macro, micro and pico cells is ideally suited both to the open countryside and to conurbations."

Towns in the south of the country will initially be connected to the GSM network, including Lillehammer, the venue for the 1994 Winter Games. Norway is a large user of cellular telephones, with 55 units per 1000 inhabitants.

Netcom is Scandinavia's third mobile network operator that chose Siemens to install network infrastructure, and follows Comvik (Sweden) and Radiolinja (Finland).

**France: Subscriber Distribution System for Fiber-Optic Networks**

93WS0094J Chichester *INTERNATIONAL TELECOMMUNICATIONS INTELLIGENCE* in English 12 Oct 92 p 3

[Article: "France: SECRE Unveils Molene for Subscriber Distribution on Optical Network"]

[Text] A subscriber distribution system for use on fibre-optic networks has been unveiled by the French company SECRE. The system, called Molene, is targeted at subscribers who require high flow rate digital connections with transmission quality offered by optical fibre systems.

The system enables up to eight subscribers to share a single fibre providing cost efficient data transmission without the need for electronic equipment in the network. Features include: integrated protection of optical and electrical channels, flexible access and flow rates, together with encryption of data transmissions.

Molene has a range of 8 km in a point-to-multipoint configuration, and 25 km in point-to-point configurations. The system provides a capacity of 16 G.703 channels at 2,048 Mbit/s with an additional potential for 48 channels at 64 Kbit/s for specialised low and medium flow digital links.

The company says the system is designed for such applications as connecting subscribers' equipment to telecommunications networks, the interconnection of digital telephone exchanges and direct subscriber-to-subscriber links.

Molene was developed by the French Centre National d'Etudes des Telecommunications (CNET). An industrial version of the prototype system was put on trial by France Telecom in Paris in 1991 (see ITI issue 248).

SECRE is currently seeking UK distributors for the Molene system and can be contacted on +33 1 44 89 45 70.

**Netherlands: Philips To Launch Multi-Standard Transmission Chip**

93WS0094K Chichester *INTERNATIONAL TELECOMMUNICATIONS INTELLIGENCE* in English 12 Oct 92 pp 3-4

[Article: "Netherlands: Philips To Launch Multi-Standard Transmission IC"]

[Text] The universal telephone could soon be a practical reality thanks to a new programmable line interface IC soon to be launched by Philips Semiconductors.

Designed by FASELEC A.G., Philips's partly-owned Swiss subsidiary, the PCA 1070 is intended for use in telephones, facsimile transceivers, cordless telephone base stations and other simple attachments to public switched telephone networks and can be programmed to meet the technical parameters for connection to any country's telephone system.

Ton van Kampen, Telecom Product Marketing Manager, says the chip will be available for sampling before the end of 1992. Projected price for the device in lots of 10,000 will be FL6.5 (£2.39).

Van Kampen describes the PCA 1070 as a multi-standard transmission device, and says it will allow PSTN terminal manufacturers to design a single circuit board for their products rather than using specific layouts tailored to the requirements of individual telecommunications approvals administrations.

"It performs all speech and line interface functions needed in an electronic telephone and requires just a handful of external components," he told ITI.

He explains, "Transmission parameters for each country network are stored as values in EEPROM, and are down-loaded into the chip by an associated microcontroller each time the phone goes off-hook." As many as 26 parameters such as line voltage, impedances, sidetone balance and audio amplification, can be programmed with the accuracy demanded by national network operators, van Dampen asserts. In Europe that means using the specifications set out in European Telecommunications Standard ETS 300/001 which sets out parameters for connection to the PSTNs of each of the members of CEPT.

Currently the market for line interface circuits is running at a rate of some 30 million pieces a year, van Kampen estimates.